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THE  
ICAL CONSTITUTION  
AND  
ONOLOGICAL ARRANGEMENT  
OF  
METEORITES.

AN INAUGURAL DISSERTATION  
ON PROMOTION TO THE DEGREE  
OF  
DOCTOR OF PHILOSOPHY  
AT THE  
GEORGIA AUGUSTA UNIVERSITY.

BY  
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1859.



BIBLIOTHECA  
REGIA  
MONACENSIS



TO

**PROF. GEORG. CLINTON WHITLOCK M.A.**

MY EARLY INSTRUCTOR AND PRESENT  
ASSOCIATE, AN ACCOMPLISHED SCHOLAR  
AND A LOVER OF SCIENCE, THESE PAGES  
ARE MOST RESPECTFULLY DEDICATED

BY

**THE AUTHOR.**

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OT

PROF. GEORGE CLINTON WHITLOCK M.A.

„Es lässt sich als ausgemacht ansehen, dass sie nicht von der Erde, sondern von einem andern Weltkörper herkommen, und folglich die Beschaffenheit der ausserhalb der Erde vorkommenden wägbaren Stoffe verkünden. In dieser Beziehung haben die Meteorsteine ein ausserordentliches Interesse.“

Berzelius.

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## REMARKS.

The plan of this dissertation was only to embrace the stone meteorites, in which I proposed to give my own analyses and then a brief account of all known meteoric stones and all the analyses of the same that have been made till the present date. But at its completion I was strongly urged by Prof. Wöhler to add to my dissertation the metallic meteorites in order that the work might be complete on this subject. And he has taken the responsibility of allowing me to use Prof. Clark's dissertation: „On metallic meteorites“ in which all till 1852 are fully described and of which I shall give a brief summary; and add to them all that has been done and discovered since that date.

Much care has been given to obtain the correct chronology and locality and to reject those of earlier times not sufficiently authenticated.



## ABBREVIATIONS.

- Am. J. sc. — American Journal of science. New Haven.  
Conn. since 1819.
- Ann. Ch. Pharm. — Annalen der Chemie und Pharmacie. Wöhler und Liebig. Heidelberg. since 1832.
- Ann. d. Chim. — Annales de Chimie. Paris 1789—1815.
- Ann. d. Ch. et Phys. — Annales de Chimie et de Physique. Paris. since 1816.
- Ann. des M. — Annales des Mines. Paris. since 1816.
- Compt. Rend. — Comptes Rendus hebdomadaires des Séances de l'Académie des Sciences. Paris. since 1835.
- D. M. — Die Meteoriten oder vom Himmel gefallenen Steine und Eisenmassen im K. K. Hof-Mineralien-Kabinette zu Wien. Paul Partsch. Vienna 1843.
- Gilb. Ann. — Gilberts Annalen der Physik. Leipzig.
- Jahresbericht; Liebig u. Kopp — Jahresbericht über die Fortschritte der reinen, pharmaceutischen und technischen Chemie, Physik, Mineralogie und Geologie. Liebig und Kopp. Giessen. since 1847.
- Jahrb. Miner. — Jahrbuch für Mineralogie, Geognosie, etc. Von Leonhard und Bronn. Stuttgart 1830—1832. Neues Jahrbuch etc. since 1833.



Journ. d. Ph. — Journal de Physique. Paris 1771—  
1823.

J. pr. Chem. — Journal für praktische Chemie. Erd-  
man. Leipzig. since 1834.

Mém. du Mus. — Mémoires du Muséum d'histoire na-  
turel. Paris. since 1812.

Monatsb. der K. Acad. Wiss. zu Berlin — Monatsbe-  
richte der Königl. Academie der Wissenschaften zu  
Berlin.

Pharm. Centr. — Pharmaceutisches Centralblatt. Knop.  
Leipzig since 1829.

Phil. Mag. — London and Edinburgh Philosophical Ma-  
gazin and Journal of science since 1832.

Phil. Trans. — Philosophical transactions of the Royal  
Society of London. since 1665.

Pogg. Ann. — Poggendorffs Annalen der Chemie und  
Physik. Leipzig since 1824.

Proc. Am. Assoc. — Proceedings of the American As-  
sociation for the promotion of science.

Ramm. Handw. — Handwörterbuch des chemischen Theils  
der Mineralogie. Rammelsberg. Berlin. fifth supple-  
ment 1853.

Rep. Am. M. — Report on American Meteorites, Shepard.  
New Haven 1848.

U. F. M. — Ueber Feuer-Meteore und über die mit den-  
selben herabgefallenen Massen. Chladni. Wien 1819.

Wien. Acad. Ber. — Sitzungsbericht der Academie der  
Wissenschaften zu Wien.



## INTRODUCTION.

Among those sciences that have had their origin and all their present growth within the narrow limits of our own age, is that branch of Aeriology which has reference to the falling of meteorites and by Shepard has been given the name, „Astrolithology.“ Since its developement commenced, no mineral substance has attracted more universal interest in circles of scientific men than those which have been seen and known to have fallen from the heavens. They come to us from regions of space beyond our power to explore, they bring with them many physical characteristics and much of the elementary constitution of their native place. But they leave us in profound mystery as to their origin, the history of their wandering and many phenomena attending their fall. The fundamental facts of this science are, that masses of stone and iron are known to fall from the heavens to our earth frequently, that their fall is attended with characteristic phenomena and that they contain chemical elements like those found on our own globe. Although the former of these, for more than three thousand years have been recognised as extra-terrestrial, and by pagan nations carefully



preserved and venerated, yet it was not until the commencement of the present century that they began to receive even a passing attention from scientific men. Men of understanding regarded them more as mythological, and were ever ready to question the facts, while others thought them some divine communication; the negro's opinion would seem to be more reasonable than both of the above when he called one. „A lump of solid thunder.“ Because the anomalous facts seemed discordant to many limited ideas of physical science at that time, they were discarded as unworthy the consideration of sound minded men. Ernst Florens Friedrich Chladni a distinguished natural philosopher was the first of learned men to admit the facts and to commence the labor of their investigation. And it was only with much perseverance and many undoubted demonstrations of nature herself that he succeeded in bringing the learned world to the acknowledgement of the fact, that masses of stone and iron are actually precipitated from the vaulted space above us to the surface of our earth. He began his publications in 1794. He then declared the facts and established them by many living witnesses and undoubted historical citations.

He supposed them identical with the luminous meteors that appear so frequently in our atmosphere. His opinions were at first looked upon as too foolish to be worthy of notice and he was thought as devoid of common sense as Franklin was at first regarded by the savants of England. Among his first opposers were



King, Bournon and Howard. In 1802. La Place gave a mathematical calculation showing that masses might be projected from the volcanoes of the moon to our earth. And in 1803 the good cause received material aid from the heavens themselves, in a most satisfactory shower of about 3000 stones, which fell near l'Aigle in France. After this it was no longer doubted that such things occur and Chladni, in pursuance of his investigations, published his great work in 1815, in which was contained a full account of all facts of the science known up to that date. During and since the time of Chladni this class of bodies has received attention from scientific men in two ways. First, many have speculated and theorized upon their origin, and others have sought after and collected facts respecting their first appearance to us during the fall, and have studied their chemical and mineralogical constitution. Among the different theories to account for their origin I will mention only those which in their turn have had a respectable class of adherers. De Luc and others supposed them to have originated with volcanoes on our earth and connected them with the phenomena of the aurora-borealis, and for this purpose supposed immense polar volcanoes which exist only in the extravagant ideas of confused brains.

Albers first made the supposition and afterwards La Place demonstrated the possibility, that they might be ejected from lunar volcanoes, and this theory was favored by Berzelius. Lichtenberg favoring this theory remarked that „the moon was an uncivil neighbor for



throwing stones at us." Others, and among them are principally von Hoff, Fisher and Shepard, suppose them to have their origin in our own atmosphere, that the materials are elevated in a gaseous or very finely divided state to the higher portions of our atmosphere where they are sustained by magneto-electric or other forces, and that a disturbance in these regions produce a meteoric fall.

I think that the amount of unsubstantiable suppositions necessary to the building of this theory, render it wholly improbable. The immense size of many masses, their chemical constitution, their structure, general appearance and specific gravity and in fact all known laws of physics relating to such substances, seem plainly to contradict such a theory. The greatest height to which materials are elevated into the atmosphere by the force of our acting volcanoes is about 6000 feet. At this comparatively small distance, the earth's attraction has not perceptibly diminished, while the density of the atmosphere has much more diminished. And the same law must continue the further we ascend; so that the heavier material substances could only be raised to a moderate height, and would then fall in the same form as when raised, as in the well known example of volcanic ashes. Their chemical constitution and in many cases crystalline structure show plainly that they have been originally at the time of their formation in a fluid condition, and in most cases in a melted state; this would be incompatible with the well known condition of the upper regions of our atmosphere.



The fall of a meteorite is usually preceded by an explosion, and a *scattering*, rather than *uniting* of fragments or bodies; evidence that some larger part or whole, enters our atmosphere from without, and from sudden heating bursts into larger or smaller particles, according to the nature and texture of the body itself. Humboldt in his „Cosmos“ has not failed to give his decided opinion in reference to these bodies. He thinks that the nature of these meteoric stones and the phenomena accompanying their fall are such as to preclude the idea of their having been condensed from minute matter or from a gaseous state, in a short interval of time. It is further known that meteoric masses kindle and become luminous at elevations which must be supposed to be almost entirely deprived of air, and frequently explode at great elevations. Their enormous and apparently planetary velocity, their oblique, and not unfrequently horizontal direction at the time of a still atmosphere, frequently in a retrograde or opposite direction to the earth's motion, are all perfectly subversive of the idea that these meteoric masses have their origin within the limits of our own atmosphere. And many chemical facts equally forbid such an assumption; one of which is whence comes the nickel and cobalt universally alloyed in considerable proportions in the metallic portion of all meteorites. They are never found so alloyed on the earth, and is only of rare occurrence and I believe never yet observed as a product of volcanoes.

The theory approved by nearly all scientific men



at present, is that first adopted by Chladni, who supposed them to be remnants of cosmotie materials, employed in the formation of worlds, or as he expressed it „*Weltspäne*.“ For this theory it is only necessary to suppose that many small bodies are revolving in space, obeying the same laws of attraction as all other members of our planetary system, but on account of their comparative minuteness are not observable before reaching the limits of our atmosphere.

This is not merely a rational supposition for explaining extraordinary facts; for astronomy brings many probabilities to our aid and assists with many facts. Matter is diffused through space in various conditions and quantities. Our present knowledge of the great quantity of nebulous matter, of its condition and relations renders it highly probable that this has something to do with the phenomena of burning meteors which are of so common occurrence especially at certain times of the year.

Furthermore the large number of asteroids now known to exist and their rapidly increasing number, give us ground for believing that an innumerable quantity of infinitely smaller bodies may be revolving in space and when they come sufficiently within the attraction of the earth, they are precipitated to its surface.

And from the chemical constitution of these wanderers, we can justly infer, that other worlds are composed of the same simple elements, and that the same chemical and physical laws prevail throughout the universe.



These wandering meteorites are greater in number than might at first be supposed. On an average about two falls are recorded each year, and these are only such as happened to be observed on the small part of the earth's surface inhabited by enlightened people, so that it would not be an extravagant supposition to conclude that a hundred such meteorites may reach our earth each year.

Their fall in approaching the earth is attended with characteristic phenomena: At first, a brilliant point, like a falling star, is seen at a great height in the heavens, which, approaching the earth, gradually enlarges and appears like a small cloud of flame. Their velocity and direction are exceedingly various; at times they fall nearly vertically, but more frequently at an inclination, and often they pass with a rapid velocity in nearly a horizontal direction.

They are surrounded by a small cloud of flame and smoke and a sharp whizzing noise can be heard in the neighborhood of the fall. From one to several explosions are heard: these occur most frequently just at the time or a little before they reach the earth, although the first explosion often occurs when considerably elevated.

The noise of the explosions is frequently very great and much resembles a heavy discharge of artillery. Generally it is but a simple mass that first reaches the atmosphere but by the explosion it is torn into fragments of various sizes, and these bury themselves in the soil to a depth proportionate to their velocity



generally a few inches, occasionally they scarcely make an impression on the surface and in a few instances they have penetrated several feet. The cause of their powerful explosion seems to remain yet a mystery. I know of nothing in their chemical composition that would be explosive under such circumstances. But it seems to me not improbable that from their porous structure they can absorb moisture and possibly other gaseous substances after reaching the atmosphere and then by the influence of heat generated by the resistance of the air, they are exploded. Pieces of a porous sand stone when thrown in the fire will explode in a few moments with much force. When found soon after falling the most of them are quite warm and some of them have been heated to a very high degree, even to a partial melting of the crust. Frequently strong fumes of sulphurous acid are emitted. Some have attempted to assign particular seasons of the year when they fall most frequently and also to give them certain localities and zones but this has no significance when considered for a sufficiently long period. R. P. Gregg has constructed some valuable tables on the dates of meteorites and from his various researches he gives the following conclusions.

First: „That the deposition of meteoric matter on the surface of the earth has not been, all things considered, otherwise than uniform.

Secondly: That their origin is not within the limits of the earth's atmosphere.

Thirdly: That they are probably distinct from or-



ordinary luminous meteorites, as regards both their physical nature and orbits.

Fourthly: That they may reasonably be considered as belonging to the group of planetoids or asteroids, and to partake, therefore of the proper nature and conditions of planetary bodies."

These meteoric bodies are divided mineralogically into two classes, viz: Stone meteorites and metallic meteorites. The former are by far the most numerous, being probably in ratio to the latter nearly as 25 : 1. And it is to the former class that my efforts have been particularly directed in the subject of this dissertation. Only a very few metallic meteorites have been observed to fall, yet there are many masses recognized and known to have been of meteoric origin, as they possess such unmistakable characteristics easily recognized by the Chemist or Mineralogist. On the contrary all meteoric stones known as such to us have been seen or heard to fall, otherwise they might not be easily recognized. They vary in weight and size from an ounce to many hundred weight.

They have a great similarity in physical and chemical constitution to the common terrestrial stone formations; but they possess a number of characteristics which definitely distinguish them from this class. The original mass before explosion is invariably surrounded with a thin crust, generally of a dull black color, but sometimes so acted upon by heat as to have a glassy or obsidian appearance.

Whether this is wholly produced after reaching the



limits of our atmosphere is a question. The inner mass has most frequently a gray appearance, in some lighter and in others darker. In a few cases they have a bluish color and compact structure, much resembling our common basalt.

The mineralogical composition of stone meteorites is a mixture of several different silicate minerals with a small quantity of sulphurets, phosphorets, chrom-iron ore and metallic iron alloyed with nickel and cobalt, and not unfrequently carbon is disseminated through the mass in small particles; and in a few cases lately observed an organic substance of a bituminous nature is found. (See my analysis of the stone from Cape of good Hope.)

The number of simple elements now recognized in these meteorites are the following:

- |              |               |                |
|--------------|---------------|----------------|
| 1. Silicon   | 8. Chromium   | 15. Phosphorus |
| 2. Iron      | 9. Copper     | 16. Sulphur    |
| 3. Nickel    | 10. Tin       | 17. Kalium     |
| 4. Cobalt    | 11. Calcium   | 18. Natrium    |
| 5. Manganese | 12. Carbon    | 19. Oxygen     |
| 6. Alumina   | 13. Arsenic?  | 20. Hydrogen.  |
| 7. Magnesia  | 14. Titanium? |                |

Shepard and Clark have given chlorine, but this formed no part of the original meteorite, it is later added. The number of distinct minerals is not very great.

The sulphates, phosphates, hyposulphites, chlorides and water given by Shepard were probably no constituents of the original meteorites, but are the result



of a later oxydation, as is also the thick crust found on some metallic meteorites.

The silicates frequently present a granulated structure showing a decided approach to crystallization, and in a few instances well formed crystals are found, from which as well as from the chemical analysis various silicates are recognized which are similar and perhaps identical with those found in our older volcanic rocks. Generally one half or more is a silicate easily decomposed in hydrochloric acid, which has the same chemical constitution as Olivine, since in all cases of correct analysis it gives the relation of Oxygen in the acid compared with that in the base in the ratio of 1 : 1. The undecomposed part is a higher silicate and evidently belongs to the feldspar family and from the relative amount of oxygen in the acid and in the base, it indicates a mixture of two or more different minerals, such as Augit, Hornblende, Orthoklas, Labradorite, Anortit etc.

The sulphurets are generally in the form of magnetic pyrites, and are disseminated in small dark colored particles through the mass.

Phosphor is a never failing element of meteorites although in very small quantity and exists in the form of a phosphoret of iron and nickel which is nearly insoluble in acid.

The metallic part is perhaps the most characteristic for this class of bodies. And this alone when present, is sufficient to distinguish them from all kinds of stone formations belonging to earth's crust. Metallic iron



may be said never to occur in our rock formations, and what is still more characteristic that this iron is always alloyed with nickel, cobalt and phosphorous. This peculiar alloy which is exclusively meteoric, occurs in nearly all meteoric stones, probably in all, but in a few instances in so small quantity that it can only be recognized by the evolution of hydrogen gas when treated with hydrochloric acid.

It is generally disseminated through the mass in small globules which have a bright metallic lustre, and vary in size from that of a small pea to very small particles. The smaller particles are more prismatic in their structure and resemble fine iron filings. The occurrence of such a metal gives us some idea of the physical circumstance in which the meteorites have previously existed. We are to infer with certainty that no water or other oxydizing substance could have existed in the localities from whence they came.

And such a state of things we know to be possible from the example of the moon which has neither water nor atmosphere, and furthermore the lithological character and structure of the stones themselves, show them to be originally of plutonic origin.

Another singular and yet interesting element which occurs not seldom in meteorites, is Carbon. It is sometimes in the form of small plates of graphit, but more frequently and in greater quantity as coal in a very finely divided state disseminated through the mass, and from this results the black color which the inner part of a few meteorits possess. This is particularly



exemplified in the meteorites from Kaba and Cape of good Hope.

Whence this coal may have originated has ever been a mystery too deep to explain, but without doubt it speaks for an organic existence of some kind in the locality where it originated.

Already Berzelius in connection with his analysis of the meteorite from Alais; France, makes the query if perhaps some organic substance might be found in connection with meteorites to which the coal could be traced and from which we might infer that organic matter exists on other globes.

This has recently succeeded and is well afforded in the two meteorites mentioned above. Prof. Wöhler has found in the stone from Kaba an organic substance which is decomposed by heat with the separation of coal. This same thing I have found in the meteorite from Cape of good Hope, in connection with which more particulars will be given. My principal object in the present dissertation is to present fully the chemical or analytical part of stone meteorites, and at the same time embrace a chronological account of all meteorites which are known to have fallen since the commencement of the christian era and to connect with each one such facts and brief descriptions so far as they are well known, as are necessary for a sufficient understanding of the same. The arrangement which I have adopted is to give my own analyses first and then the others in their chronological order.

In collecting facts I have made free use of the ex-



cellent works of Chladni, Partsch, Shepard and Clark and the labor of search has necessarily extended to all the chief scientific journals of Germany, France, England and America. In the analyses given we have sought carefully for the plan most adapted to so complicated an analysis and most subservient to satisfactory results, and for this I am chiefly indebted to my highly honoured instructor, Prof. Wöhler who has rendered me every possible assistance, and bestowed every favor and kindness worthy of a great mind and a noble heart.



### METEORIC STONE FROM KAKOVA.

1858 May 19. A meteoric stone was seen to fall near Kakova in Hungary. It fell at 8 oclock in the morning, the weight was one pound and one ounce. The fall was witnessed by some herdsmen in a locality called „Valia lui Middin.“ They heard at first a low rumbling noise like distant thunder and then suddenly a sharp whizzing in the atmosphere near them. They saw in rapid motion a small dark colored object enveloped in a small cloud of smoke. At or near the time when it reached the earth, a sharp explosion was heard similar to the report of a common gun; and from it there arose a cloud of smoke. The same phenomena as above described were witnessed at several adjoining places. The herdsmen hastened to the place where it was seen to fall, and found a black mass buried three inches in the soil, and the grass, about the place where it entered, was burnt.

Zsursz Csinka, the eldest of the herdsmen found the mass too warm to hold in his hand. It had been broken by the explosion in several pieces, these were all carefully collected so that but one small piece of the crust fails. It was brought by the shepherds



to the governor or lord of this district „Graf von Coronini“ and by him was presented to the meteoric cabinet in the royal collection at Vienna.

Dr. Hörnes the director of the cabinet at Vienna on comparing this meteorite with the many others of that collection, found that it has the greatest similarity with the meteorite from Tennessee (U. S. A.) which fell May 9. 1827.

The ground mass is somewhat granulated in structure and is of a light gray color, but when more closely observed by means of a small magnifying power, it seems to be a mixture of a light colored mineral like Feldspar and a dark colored mineral, the latter consists of smaller particles and is in less quantity than the former. Much metallic iron is distributed through the mass in the form of small globules varying considerably in size. The inner mass was surrounded by a thin black crust which had the appearance of having been partly melted in some places but the surface was of a dull color. The analysis of this stone was committed to the care of Prof. Wöhler and by him was intrusted to me. Only a couple of small fragments which together weighed about 6 gramms were allowed for the analysis, and with this we wished to make a sufficient number of analyses to determine the relative quantity of the elementary substances and also the quantity of the different kinds of minerals there contained. The stone was quite hard and compact and pulverized with some difficulty especially on account of the globules of metallic Iron present.



By a continued rubbing in the agate mortar the ground mass became nearly all separated from the globules of iron and then a mechanical separation was made by means of the magnet. This operation was continued so long as any magnetic particles adhered to the magnet. The magnetic part was again rubbed in the mortar and again taken up with the magnet, but still a small quantity of the silicate mineral remained hanging upon the magnetic part, and a small quantity of metallic iron remained with the silicates as the following analyses will show. The result of this separation was

Magnetic part. 8.56

Unmagnetic part. 91.44

In the following description I will give the manner and plan of my analyses which I have followed in the three different meteorites which I have examined. I will speak first of the silicates in the unmagnetic part and secondly of the magnetic part. The finely pulverized substance was much darker colored than the original stone.

Three different analyses I have made of this part. First. A portion was melted with carbonate of soda. Second. A portion was decomposed with hydrofluoric acid, in order to determine the alkalies. Third. A portion was digested with concentrated hydrochloric acid in order to separate the two classes of silicates which are always present in meteoric stones. These three analyses I will designate successively by the letters A. B and C.



A.

The substance was thoroughly melted in a fourfold amount of carbonate of soda and potassa. A little nitrate of potassa was added in order to oxydize the small amount of metallic substance which might be present. The Silica was then separated and determined in the usual manner. The solution which remained after being suitably concentrated was treated with sulphureted hydrogen. The sulphur that was precipitated was colored brown by a small quantity of copper present. The filtered solution was then boiled till free from sulphureted hydrogen and a small quantity of nitric acid added for the higher oxydation of the iron. The solution was then saturated with ammoniak by which all the iron, alumina, chrom, phosphoric acid and a part of the manganese are precipitated. And here I might remark that much care should be taken to have a sufficient quantity of salmiak present and to stir the solution well while precipitating in order to have the magnesia remain fully in solution. The precipitate after being well washed, was dissolved in hydrochloric acid, and then heated to boiling, at the same time adding small quantities of sulphurous acid until all the iron was reduced to the protoxyd. Then the iron was precipitated by an excess of caustic potassa. This precipitate was cooked in the solution until it became black and much condensed. In the filtered solution alumina was precipitated by sulphuret of ammonium after it was neutralized by acid. The above precipitate containing iron, Manganese etc. was dissolved in acid



and considerable water added to the solution. The iron was then precipitated by carbonate of soda the solution being added only a drop at a time until all the iron was precipitated. The manganese remained in solution being desolved in the free carbonic acid. In the filtered solution I have used different methods to precipitate the manganese. First by boiling the solution until all free carbonic acid was liberated and then carbonate of manganese is precipitated, but a still better method is to precipitate with hypochlorite of soda; after remaining twenty four hours all the manganese is precipitated as peroxyd. The above iron precipitate was dissolved and precipitated by ammonia, and then weighed, afterwards the phosphoric acid and the chromium can be separated from the iron by melting with the nitrate of potassa, when the chromium can be reduced to oxyd by a few drops of alcohol and then precipitated by ammonia. The phosphorus, although always present in meteorites, yet is frequently in so small quantity as to evade all common means of its detection; but the smallest trace can be detected and generally determined by adding nitric acid to the solution and then a few drops of Molydanate of ammonia, and afterwards heating the solution to boiling; a yellow precipitate will be given which contains about 3,5 percent. of phosphoric acid.

To the solution containing the other substances sulphuret of amonium was added by which nickel and the remainder if there be any of manganese is precipitated. After the sulphuret of nickel is fully settled



which often requires some time, it is filtered and the precipitate dissolved in „aqua regia“, partly neutralized by Carbonate of soda, and then a slight excess of acetate of soda is added to the solution, which is then comes treated with sulphureted hydrogen by which only the nickel is precipitated. These are then determined in the usual manner.

The solution containing the other substances is first suitably concentrated by evaporation and then Oxalate of ammonia is added and allowed to remain twenty four hours. The oxalate of lime is then filtered up and determined in the usual manner. In the remaining solution magnesia is precipitated by phosphate of ammonia and then weighed after all the ammonia is driven off by heat.

In this analysis the following determinations were made.

| Si O. <sup>3</sup> | Mg O  | Fe O  | Ca O | Mn O | Cu     | P      |
|--------------------|-------|-------|------|------|--------|--------|
| 41.14              | 27.06 | 24.47 | 0.68 | 0.50 | Trace. | Trace. |

A small quantity of nickel was determined but this does not belong to the silicates but to the metallic or magnetic part., so that from the relative proportions of iron and nickel found in the analysis of the magnetic part, we have calculated the amount of nickeliferous iron which was in this analysis and have reckoned it from the result found.

#### B.

The silicates in this analysis were decomposed by hydrofluoric acid in which the material was allowed



to digest for several days in a platin vessel. When fully decomposed it was evaporated to dryness and treated with a small quantity of concentrated sulphuric acid and then heated till all excess of acid was driven off. The remaining sulphates were dissolved in water a few drops of hydrochloric acid being added in order to dissolve more readily the small quantity of sulphate of lime. There remained a small quantity of a black substance which appeared to be graphite and as such I have given it in the analysis.

In the filtered solution the iron, alumina, nickel, lime etc. were precipitated and treated in the same manner as in the preceding analysis, and their results used to control the corresponding results of the preceding analysis. When only magnesia and the alkalies remained in the solution it was evaporated to dryness and heated till freed from all ammonia salts and the following method used to separate the magnesia from the alkalies. A slight excess of sulphuric acid was added so that we might have the substances in the form of sulphates; this method seemed the best under the circumstances as already some sulphuric acid was present. After all excess of acid was driven off by heat the sulphates were dissolved in water and then precipitated by a solution of pure acetate of baryta; the precipitate was boiled in the solution and then allowed time to settle. In the filtered solution we had the acetates of magnesia, soda, potassa and baryta, this was carefully evaporated to dryness in a platin dish and then heated till the acetates were fully decomposed



The substances then were all in the form of carbonates and consequently only the alkalies would be dissolved out by water. This solution was carefully evaporated to dryness and then changed to chlorides, and in this condition both were weighed together. They were then desolved in a small quantity of water and a solution of chlorid of platinum added and the solution evaporated to dryness over a water bath. A few drops of water were added sufficient to make the substance moist and after remaining a short time was treated with alcohol. The potasso was thus determined direct and the soda was reckoned from the loss in weight.

From this analysis the following determination were made the nickel and the corresponding amount of iron being reckoned out the same as in the preceeding analysis,

| FeO   | Al <sup>2</sup> O <sup>3</sup> | Ca O | Mn O | Na O | K O  | Graphit | S      |
|-------|--------------------------------|------|------|------|------|---------|--------|
| 23.95 | 2.46                           | 0.81 | 0.40 | 1.92 | 0.56 | 0.15    | Trace. |

From the two preceeding analyses we have the following for the composition of the stone as a whole without the magnetic part.

|                       |              |
|-----------------------|--------------|
| Silica                | 41.14        |
| Magnesia              | 27.06        |
| Protoxyd of Iron      | 24.57        |
| Alumina               | 2.46         |
| Lime                  | 0.75         |
| Protoxyd of Manganese | 0.46         |
| Soda                  | 1.92         |
| Potassa               | .56          |
| Graphit               | 0.15         |
| Sulphur               | Trace        |
| Copper                | Trace        |
|                       | <hr/> 99.07. |



## C.

This analysis was made for the purpose of separating the two different classes of silicates which generally occur together in stone meteorites. For this purpose a quantity was digested several hours in concentrated hydrochloric acid.

The whole was then evaporated to dryness over a water bath, moistened with a few drops of acid, water was then added and the insoluble parts filtered up. The liberated silica was separated from the undecomposed silicate by boiling for a long time in a concentrated solution of carbonate of soda. In the solution which contained the other substances, the separations and determinations were made in the same manner as in the preceding analyses. It was not considered necessary to determine the alkalies in this analysis as only so small a quantity is in the decomposed silicates; From this analysis we have the following result:

|                               |            |
|-------------------------------|------------|
| Silicate undecomposed in Acid | 43.3       |
| Silica in the part decomposed | 19.5       |
| Protoxyd of Iron              | 24.4       |
| Magnesia                      | 11.2       |
| Nickel                        | 0.2        |
| Lime                          | 0.6        |
| Sulphur                       | Trace      |
|                               | <hr/> 99.2 |

The result of this analysis gives

|                         |      |
|-------------------------|------|
| Undecomposed Silicate   | 43.3 |
| Decomposed           ,, | 56.7 |



And the 56.7 decomposed silicate contain:

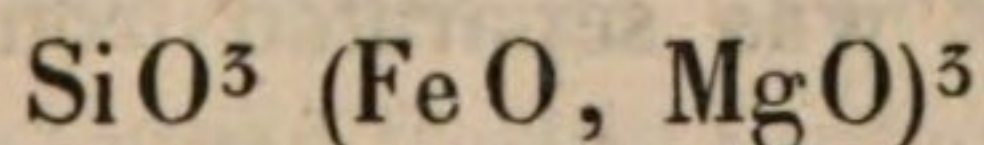
|                  |            | (or in 100 parts) |
|------------------|------------|-------------------|
| Silica           | 19.5       | 34.40             |
| Magnesia         | 11.2       | 19.95             |
| Protoxyd of Iron | 24.4       | 43.04             |
| Nickel           | 0.2        | 0.35              |
| Lime             | 0.7        | 1.24              |
| Sulphur          | Trace      | —                 |
|                  | <hr/> 56.0 | <hr/> 98.98.      |

The small quantity of nickel here given does not properly belong to the silicate mineral but this with a corresponding amount of iron is probably a small quantity of the metallic part not separated by the magnet.

In regarding the amount of oxygen contained in the silica compared with that of the bases we have.

$$\begin{array}{rcl}
 19.5 \text{ Si O}^3 & = & \begin{array}{l} \text{(Oxygen)} \\ 10.3 \end{array} \\
 24.4 \text{ Fe O} & & \\
 11.2 \text{ Mg O} & & \\
 0.7 \text{ Ca O} & & \\
 & & \left. \begin{array}{l} \\ \\ \\ \end{array} \right\} = \begin{array}{l} \text{(Oxygen)} \\ 10.1 \end{array}
 \end{array}$$

This is the well known relation that exists in olivine and that class of minerals allied to it. And in this instance we have an olivine mineral very rich in protoxid of iron as is frequently the case in meteorites and we can place it under the following formula.



The 43.3 undercomposed silicate contain.

|          |             | (or in 100 parts.) |
|----------|-------------|--------------------|
| Silica   | 21.74       | 50.49              |
| Magnesia | 15.86       | 36.84              |
| Lime     | .81         | 1.88               |
| Alumina  | 2.46        | 5.71               |
| Soda     | 1.92        | 4.45               |
| Potassa  | 0.26        | 0.59               |
|          | <hr/> 43.05 | <hr/> 99.96.       |



For this part the ratio of the oxygen in the silica to that in the bases is about 11.3 : 7.6 and from this it is evident that more than a simple mineral is present in this part as is usual in meteorites. And this example corresponds very nearly with that found by Rammelsberg in the stone from Klein-Wenden which fell Sep. 16. 1843. Prof. Sartorius von Waltershausen has favored us with his study to refer this to the most probable mineral substances, and he finds that this undecomposed part gives exactly 82.17 per. cent. magnesia - wollastonite  $(\text{Ca O. Mg O})^2 \text{Si O}^3$  and 17.4 per. cent. anortit  $(\text{Na O K O}) 2 \text{S O}^3 + \text{Al}^2 \text{O}^3, 2 \text{Si O}^3$ . But by referring them to these chemical formulae we must suppose that anortit and wollastonit are not easily decomposed by hydrochloric acid.

---

### MAGNETIC PORTION.

This consisted of the metallic part of the meteorite and is common to the larger class of meteoric stones. As above stated it was separated from the other part of the stone by means of a small magnet. Some of the globules showed a bright metallic luster and others were more or less oxydized on the surface. When separated it was properly a specimen of meteoric iron and showed all the properties and chemical constitution of such. For its analysis it was treated with hydrochloric acid and like many meteoric irons it seemed to be passive, scarcely any gas evolution being observed, but on raising the



temperature the action commenced and continued slowly till all the metallic part was dissolved.

The solution was filtered from the small amount of silica and undissolved mineral; the acid solution neutralized and the iron precipitated by succinate of ammonia and determined in the usual manner.

The solution after being sufficiently concentrated was treated with a slight excess of sulphuret of ammonia and allowed to stand until the precipitate was fully settled and the solution clear, when it was filtered off and evaporated, by which operation a small quantity of sulphuret of nickel was precipitated. This was filtered again and the operation repeated till no nickel remained in solution. The sulphurets were then dissolved in aqua regia and precipitated by potassa. The weight was taken and then dissolved in hydrochloric acid, reprecipitated by potassa, brought upon a filter and washed. The moist oxyds were then dissolved by means of Prussic acid and potassa in a mixed solution. The solution was sufficiently boiled to expell all excess of Prussic acid and to convert the cyanide of cobalt and potassium into sesquicyanide. The nickel was then precipitated by means of freshly prepared oxyd of quicksilver. The cobalt was precipitated by means of the nitrate of the suboxyd of quicksilver. The precipitate containing the cobalt mixed with the subchloride of quicksilver, was roasted in a porcelain crucible until nothing but the black oxyd of cobalt remained. Their weight separately when added gave the same as their united weight before separation. In the remaining



solution the magnesia was determined in the usual manner, and from its amount we reckoned the small amount of decomposed silicate which was mixed with the metallic part, and after taking away from the results found, the amount of silicate, we obtain the chemical constitution of the metallic part alone.

With the iron was precipitated the phosphoric acid and the chromium. They were melted in a mixture of carbonate and nitrate of soda, and the latter substances dissolved in water; The chromic acid was precipitated by acetate of lead, and in the analysis we have calculated to the formula for chromic iron  $\text{FeO Cr}^2\text{O}^3$ . The solution gave no perceptible precipitate with ammonia and magnesia salts. It was then made acid by means of an excess of nitric acid and a few drops of molybdenate of ammonia were added and then heated to boiling; from the amount of the yellow precipitate was determined the amount of phosphoric acid present. In the above manner of determination the following analysis was determined.

|              |             |
|--------------|-------------|
| Iron         | 82.95       |
| Nickel       | 14.41       |
| Cobalt       | 1.08        |
| Chromic Iron | .76         |
| Phosphor     | .12         |
| Sulphur      | Trace       |
| Copper?      | —           |
|              | <hr/> 99.32 |



### METEORITE FROM CAPE OF GOOD HOPE.

A remarkable fall of meteorites occurred at Cold Bokkewald, Cape of Good Hope Oct. 13. 1838. A large bright meteor passed nearly horizontally in a S. E. direction, and was observed for a long distance in its passage, and created no little excitement among the astonished beholders. A powerful explosion was repeated several times and resembled a heavy discharge of artillery. It was distinctly heard at a distance of 40 miles. The number of stones that fell was very great; and some of them were of great weight. The mass is homogeneous in structure and is characterized by a dull black color which is not common for the inner mass of meteorites. No metallic iron is to be seen but a little is detected by means of acid.

It is very incoherent and therefore easily broken and pulverized; it has a dull black crust inseparable from the inner mass and differs from it only in being harder and shows signs of having been highly heated.

The characteristics of this meteorite from Cape of Good Hope are somewhat singular; especially its black color through the entire ground mass and Faraday speaks nothing of it in his analysis and in his result gives



nothing to which it might be attributed. And on account of its similarity in appearance and structure to the one which fell at Kaba Hungary April 15 1857 and recently carefully analysed by Professor Wöhler; it was suggested that another examination should be made of that meteorite. Through the kindness of Dr. Hörness who has care of the royal collection at Vienna we obtained 5 grams of small fragments. Several experiments at first were made to test if possible the cause of this black color which is common only to a very few stone meteorites.

1st A small quantity of the finely powdered substance was digested in strong acid. A part of the mineral was decomposed and silica liberated, but in other respect the color remained unchanged.

2d A small quantity of the powder was heated on platinum foil before the blowpipe.

The color disappeared, and slight scintillations were observed and the remaining substance had a light gray color.

3d A couple of small pieces not pulverized were digested in acid, and the coloring was removed from many small circular spots and otherwise not changed, so that it gave exactly the appearance of leucit lava.

4th A small quantity of fine powder was heated in a small tube closed at one end. At first a little water was given off and then we observed a peculiar empyreumatic smell, like that from the burning of some bituminous substance. This indicated that something volatile was



present although perhaps in small quantity. The same color remained unchanged by this operation.

5th The whole quantity of substance was finely pulverized and digested for two hours in absolute alcohol, great pains were taken to obtain that which was pure. After the digestion it was filtered. The alcohol was slightly colored yellow. This solution was carefully evaporated to dryness. There remained a resinous substance of a reddish brown color, not hard but soft and plastic. It was not in a condition to weigh but was not less than  $\frac{1}{4}$  pr. cent. of the whole mass. Alcohol was again added to it and it became completely dissolved. The solution in Alcohol when warm and concentrated was colored red. To this solution a few drops of water were added and the substance was immediately precipitated. It was again evaporated to dryness and pure sulfuric aether was added. In this it became likewise dissolved, thus giving all the reaction and peculiarities of common resinous substances. All possible attempts were made to have it crystallize out of its solutions, but all to no purpose. It remained the same as described above. The solution in aether was then evaporated to dryness. As much as possible was scraped from the glass and put in a narrow tube closed at one end, and then was heated over a spirit lamp. It melted at first and a few drops seemed to sublime further up the tube. A strong empyreumatic odor was evolved like that from the burning of many bituminous substances. The substance in the tube became decomposed and carbon



was deposited. This is a second example in which such an organic substance has been found in meteoric stones, and it may well be said to be a singular and remarkable occurrence and at all events it will add one new fact to our limited knowledge of these mysterious wanderers, which come to us from regions unknown. But in what way this organic substance could have its origin must be a difficult question to solve. From the decomposition of this in an elevated temperature would be deposited the carbon found not unfrequently in meteoric stones.

The plan and manner of the complete analysis will be found with the analysis of the meteorite from Kakova and I shall only mention such points of the analysis here as are peculiar to this one and are not there mentioned.

The substance after being treated as above mentioned was dried for some time by a moderate temperature, and then from the fact that when the black substance was heated on platin foil there remained only a grayish white mineral substance it was supposed to contain carbon, and for its determination a weighed portion was put in the bulb of a glass tube and this connected at one end first with a glass tube filled with the peroxyd of lead and to this was connected a Liebig's bulb apparatus filled with a clear solution of baryta and to this a small glass tube filled with small pieces of hydrated potassa. The other end of the tube was connected with a gasometer containing oxygen and this was rendered perfectly pure before allowed to pass into



the tube. The object of the tube filled with peroxyd of lead was to arrest all sulphurous acid vapor which might be formed and not allow it to pass into the solution of baryta. A very slow stream of gas was passed through the apparatus and then the substance was heated.

First a considerable quantity of water was driven out and deposited in the tube. This we reckon as not properly belonging to the meteorite but owing to its exceedingly porous structure like many clay substances it has absorbed moisture since its fall, and in order to be fully deprived of this it must be heated much higher than the boiling point of water. With the evaporation of the water and during the first part of the operation some white fumes passed off and a small quantity of a white crystalline substance was deposited not far from the bulb; the water in the tube being saturated with this was carefully examined and found to contain sulphuric acid and ammonia.

As soon as the substance became fully dried a precipitate began to form rapidly in the baryta solution. The operation was continued as long as necessary, and then the apparatus containing the carbonic acid was weighed and the excess above its previous weight gave the amount of carbonic acid. And as result we obtained 1.67 percent. of carbon in the substance after the water was reckoned out which was afterwards determined.

Acid was added to the carbonate precipitate afterwards and it dissolved completely with an evolution of much carbonic acid. The substance in the tube



after being thus treated was wholly changed in appearance. It was now a reddish brown powder. Three analyses were made in the manner given by the Kakova meteorite.

First: the analysis by melting with carbonat of soda and potassa gave the following determinations

| SiO <sup>3</sup> | FeO   | MgO   | CaO  | Ni   | MnO  | Al <sup>2</sup> O <sup>3</sup> | Cr <sup>2</sup> O <sup>3</sup> | Cu   | P      |
|------------------|-------|-------|------|------|------|--------------------------------|--------------------------------|------|--------|
| 30.80            | 33.22 | 22.40 | 1.80 | 1.30 | 0.97 | 2.06                           | 0.76                           | 0.03 | Trace. |

Second: the analysis with hydrofluoric acid gave the following determination.

| FeO   | MgO   | Al <sup>2</sup> O <sup>3</sup> | Cr <sup>2</sup> O <sup>3</sup> | FeO | NaO + KO |
|-------|-------|--------------------------------|--------------------------------|-----|----------|
| 33.06 | 21.60 | 1.93                           | 0.30                           |     | 1.23.    |

Third: an analysis was made by treating the substance with aqua regia and from this the following determinations made:

|                                     |       |
|-------------------------------------|-------|
| Sulphur                             | 3.38  |
| Silicate undecomposed               | 5.46  |
| SiO <sup>3</sup> in part decomposed | 28.44 |
| Protoxyd of Iron                    | 33.19 |
| Magnesia                            | 18.41 |
| Lime                                | 1.60  |
| Alumina                             | 1.54  |
| Manganese                           | 0.34  |

On this analysis it is to be remarked in reference to the sulphur there contained that no sulphuretted hydrogen was evolved on treating the substance with hydrochloric acid, showing that the simple protosulphuret of iron was not present, but the substance heated



on platin foil gave a strong odor of sulphurous acid showing that a sulphuret of some kind was present. Also a small piece of the stone was heated in a glass tube closed at one end and no sulphur was deposited in the tube showing that no bisulphuret was present. The amount of sulphur was determined by treating the substance with aqua regia and thus the sulphur was oxydized to sulphuric acid and then determined as sulphate of baryta. The substance treated with water gave a clear test for sulphuric acid and magnesia showing that a small quantity of the sulphur had been oxydized but from the want of more material we could not determine the quantity thus oxydized, but the most existed yet in the form of some sulphuret. Prof. Wöhler has studied the analysis and my experiments closely in order to solve this and it appears that the amount of nickel is too great for the small amount of metallic Iron present as scarcely a particle could be extracted from the powdered mass by means of a magnet but by hydrochloric acid hydrogen gas was evolved for a few moments and then ceased. From this he concludes that the nickel exists there in the form of a sulphuret, and he thinks it probable that a chemical combination is there which may have the following formula ( $\text{NiS}$ ,  $\text{Fe}^2\text{S}^3$ ). The amount of sulphur determined corresponds very nearly to this formula. And in order to strengthen this supposed formula, we have made many experiments with sulphurets of iron and nickel, and found that a mixture of the two, or rather when the two metals in like quantity were mixed and



then melted in sulphur and then treated with hydrochloric acid, that only a small part was dissolved, and the residue gave no sulphureted hydrogen when boiled in hydrochloric acid.

We have therefore reckoned the analysis after that manner and we give the amount of organic matter as 0.25 percent but it probably somewhat exceeded this. Accordingly we give the following for the whole analysis :

|                       |             |
|-----------------------|-------------|
| Carbon                | 1.67        |
| Bituminous substance  | 0.25        |
| Iron                  | 2.50        |
| Nickel                | 1.30        |
| Sulphur               | 3.38        |
| Silica                | 30.80       |
| Protoxyd of Iron      | 29.94       |
| Magnesia              | 22.20       |
| Lime                  | 1.70        |
| Alumina               | 2.05        |
| Oxyd of Chromium      | 0.76        |
| Soda and Potassa      | 1.23        |
| Protoxyd of Manganese | 0.97        |
| Copper                | 0.03        |
| Phosphorus and Cobalt | Trace       |
|                       | <hr/> 98.79 |

Also by the determinations made in the analysis by means of aqua regia we can give the following composition :



|                                  |             |
|----------------------------------|-------------|
| Undecomposed silicate            | 5.46        |
| Silica in the decomposed mineral | 28.44       |
| Iron                             | 2.50        |
| Protoxyd of Iron                 | 29.98       |
| Magnesia                         | 18.41       |
| Lime                             | 1.60        |
| Nickel                           | 1.30        |
| Alumina                          | 1.58        |
| Soda and Potassa                 | 1.23        |
| Manganese                        | 0.44        |
| Oxyd of Chromium                 | 0.76        |
| Sulphur                          | 3.38        |
| Carbon                           | 1.67        |
|                                  | <hr/> 96.75 |

From the above analysis we perceive the stone consists mostly of an easily decomposed silicate and it has the chemical formula for olivine as shown from the relative amount of oxygen in the acid and base.

Oxygen in Silica = 15.1.

„ „ Bases = 15.3.

A part of the loss in the above analysis is probably due to some silica that was washed through the filter, as I found it difficult to render it perfectly dry on account of so much chlorid of Iron being present. In my next analysis I found this the case and determined the amount that passed through. The small quantity of undesolved silicate was partially analyzed and found to be a silicate of alumina, magnesia, manganese and oxyd of Iron and probably alkali, but the quantity was too small to determine any correct formula. It is



evidently a silicate of the feldspar family. From the foregoing analyses we conclude that the stone has nearly the following mineralogical composition.

|                         |        |
|-------------------------|--------|
| Olivine Silicate        | 84.33  |
| Feldspar                | 5.46   |
| Iron and Nickel pyrites | 7.18   |
| Carbon                  | 1.67   |
| Chrom Iron ore          | 1.11   |
| Organic Substance       | 5.25   |
|                         | <hr/>  |
|                         | 100.00 |

From the above analysis we perceive the stone consists mostly of an easily decomposed silicate and it has the chemical formula for olivine as shown from the relative amount of oxygen in the acid and base.

$$\begin{aligned}\text{Oxygen in Silica} &= 15.1 \\ \text{Bases} &= 15.3\end{aligned}$$

A part of the loss in the above analysis is probably due to some silica that was washed through the filter as I found it difficult to render it perfectly dry on account of so much chlorid of iron being present. In my next analysis I found this the case and determined the amount that passed through. The small quantity of undissolved silicate was partially analyzed and found to be a silicate of alumina, manganese, and oxyd of iron and probably alkali, but the quantity was too small to determine any correct formula. It is



# METEORITE FROM MONTREJEAN NEAR AUSSON IN FRANCE.

This large stone meteorite fell at the above locality Dec. 9. 1858 at 7 oclock in the morning; and is the most recent fall known at this date. Its course was from N. E. to S. W. and was first observed about 40 miles from where it fell.

Its explosion on reaching the earth was equal to a heavy report of thunder and the stone was broken into several fragments. The whole weight was probably between 100 and 120 pounds. The largest piece fell near the village Ausson and sunk over four feet in the ground, its weight was 80 pounds. The stone was broken in pieces by the inhabitants and much of it was lost. Its physical character is common to a large class of meteorites. It has a light gray ground mass, but this is not homogeneous. The greater part has a granulated structure and is not difficulty broken and pulverised. Scattered through all parts of the mass are peculiar spherical concretions which can be separated from the other part; these are more compact in structure and have more of a brownish color. It contains much metallic Iron. Many small rust spots can be seen upon all surfaces where it has been



broken. The whole mass is surrounded with a thin black crust. It has a specific gravity of 3.3.

I procured a specimen of this meteorite not long after it fell and at my earliest opportunity commenced the analysis, but before mine was completed two analyses were published at the same time in Paris. The one by messrs Filhol and Leymerie, the other by messrs G. Chancel and Montissier.

The first is found in Compt. Rend. vol. 48. P. 193. Of the unmagnetic part he gives the following analysis: A = part easily attacked by acid. B = part more difficultly attacked by H. Cl. C = Composition of the whole. D = the silicate after the sulphuret of iron was reckoned out.

|     | SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | MgO   | FeO   | Fe <sup>2</sup> O <sup>3</sup> | CAO  | NaO  | S         |
|-----|------------------|--------------------------------|-------|-------|--------------------------------|------|------|-----------|
| A = | 64.35            | Trace                          | 12.70 | 16.80 | 2.00                           | 0.55 | 1.60 | 2.00=100. |
| B = | 52.05            | 11.40                          | 18.45 | 16.50 | —                              | —    | 1.60 | — =100.   |
| C = | 61.85            | 2.00                           | 11.80 | 16.90 | 2.55                           | 0.60 | 2.30 | 2.00=100. |
| D = | 65.11            | 2.10                           | 12.92 | 14.46 | 2.68                           | 0.63 | 2.40 | — =100.   |

This every one who has had any thing to do with stone meteorit analyses, will soon recognize as *exceedingly* incorrect. First: the fact that all of them equal 100 is „*prima facie*“ evidence that skilfull reckoning rather than accurate determinations have favored such extraordinary results. Secondly; he states in his description that the silicates are all or nearly all decomposed by hydrochloric acid, and by examining the amount of oxygen in the silica and in the bases of his silicates I find them nearly in the ratio of 4:1. Now what this mineral can be with such proportions of



oxygen and so easily decomposed I can have no conceptions. The feldspar richest in silica has the ratio of 3 : 1 and this is wholly unattacked by H Cl. And should he establish the fact of such a silica combination, it would do him more honor than his present analysis. His fault is probably in supposing that all was decomposed by H. Cl. for that is a great mistake.

I have made the analysis of this stone with considerable care and in the same manner as in the two preceeding. The metallic part was separated by means of a magnet, and after the analysis the small quantity of silicate attached to the metallic part was reckoned out. This gave me.

Magnetic part = 8.41

Unmagnetic part = 91.59

Of the latter an analysis was first made by melting with carbonate of soda and potassa, and another by treating with hydrofluoric acid and the result of these with the sulphur taken from another analysis gave me the following constitution.

|                   |       |
|-------------------|-------|
| Silica            | 42.00 |
| Alumina           | 2.46  |
| Oxyd of Chrome    | .83   |
| Protoxyd of Iron  | 19.65 |
| Iron as Sulphuret | 2.74  |
| Manganese         | 0.33  |
| Magnesia          | 27.39 |
| Soda              | 1.23  |
| Potassa           | 0.20  |
| Sulphur           | 2.09  |
| Copper and Tin    | 0.26  |
| Kalk ?            | —     |

---

99.18



In the above there is a mixture of different silicates with sulphurets etc.

With hydrochloric acid some sulphuretted hydrogen was evolved but not very readily, so I made an analysis by treating the substance with aqua regia and thus the sulphur became oxydized to sulphuric acid, and a part of the silicate was decomposed. From this I obtained the following result.

|                                 |              |
|---------------------------------|--------------|
| Undecomposed minerals           | 42.43        |
| Silica in decomposed part       | 20.15        |
| Sulphur                         | 2.09         |
| Iron in the sulphuret           | 2.74         |
| Protoxyd of Iron                | 15.25        |
| Protoxyd of Manganese           | 0.20         |
| Magnesia with a trace of Alkali | 17.14        |
|                                 | <hr/> 100.00 |

In this case the magnesia is reckoned from loss on account of using a method to separate the magnesia from a small trace of alkali which proved incorrect.

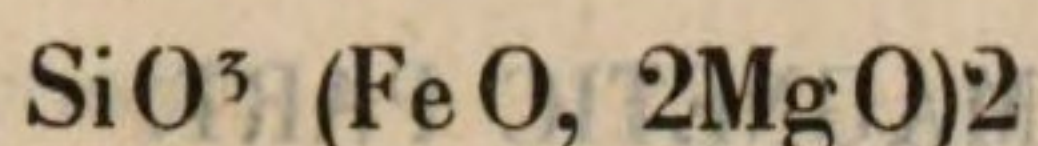
This gives us 4.83 percent magnetic pyrites, and 52.74 of decomposed silicate which contains:

| (or in 100 parts) |             |              |
|-------------------|-------------|--------------|
| Silica            | 20.15       | 38.75        |
| Protoxyd of Iron  | 15.25       | 28.90        |
| Magnesia          | 17.14       | 32.48        |
| Oxyd of Manganese | 0.20        | 0.37         |
|                   | <hr/> 52.74 | <hr/> 100.00 |

In this the ratio of oxygen in the silica compared to the bases is as 10.6 : 10.3.

This reduces almost exactly to the formula





which is a well known formula for olivine. From the first analysis we have 1.11 percent chrome iron ore; this taken from the above undecomposed part gives us 41.30 of undecomposed silicate. And according to the above analyses this would contain:

| (or in 100 parts.) |              |               |
|--------------------|--------------|---------------|
| Silica             | 21.85        | 52.90         |
| Protoxyd of Iron   | 4.13         | 10.00         |
| Magnesia           | 10.25        | 24.82         |
| Oxyd of Manganese  | 0.13         | 0.31          |
| Alumina            | 2.46         | 5.96          |
| Soda               | 1.23         | 2.98          |
| Potassa            | .20          | 0.48          |
|                    | <u>40.25</u> | <u>97.45.</u> |

In looking at this composition I think that the alumina and the alkalies belong to Labradorite or Oligoclas but there is not a sufficient quantity of alumina and silica to make it all this mineral and I think it refers well to the two following.

| Labradorite and |              | Augit. oxygen         |              |
|-----------------|--------------|-----------------------|--------------|
| Silica          | 10.70        | Silica                | 42.20 22.35  |
| Alumina         | 5.96         | Protoxyd of Iron      | 10.00        |
| Soda            | 2.98         | Magnesia              | 24.82        |
| Potassa         | .48          | Protoxyd of manganese | .31          |
|                 | <u>20.12</u> |                       | <u>77.33</u> |



## MAGNETIC PART.

This was easily dissolved in hydrochloric acid and gave the following chemical composition:

|            |              |
|------------|--------------|
| Iron       | 84.71        |
| Nickel     | 12.11        |
| Cobalt     | 0.72         |
| Manganese  | 0.50         |
| Sulphur    | 2.14         |
| Phosphorus | Trace        |
| Chromium   | „            |
|            | <hr/> 100.18 |

This would give

|                    |              |
|--------------------|--------------|
| Magnetic pyrites   | 4.95         |
| Nickeliferous Iron | 95.05        |
| Chrom Iron         | Trace        |
|                    | <hr/> 100.00 |

The whole stone would then have the following Mineralogical composition.

|                          |              |
|--------------------------|--------------|
| Metallic Iron and Nickel | = 8.00       |
| Chrom, Iron              | 1.03         |
| Magnetic pyrites         | 4.83         |
| Olivine Silicate         | 48.31        |
| Labradorite              | 7.79         |
| Augite                   | 30.04        |
|                          | <hr/> 100.00 |

Messrs G. Chancel and Montissier of Paris have given an analysis of the stone (Compt. Rend. vol. 48. p. 267) which corresponds almost exactly with my own so far as they have made determinations. According to them the whole mass would contain:



## Magnetic portion

|                        |      |   |               |
|------------------------|------|---|---------------|
| Iron                   | 8.36 | } | 10.04         |
| Nickel                 | 1.56 |   |               |
| Phosphuret of Iron     | .07  |   |               |
| Sulphur                | .05  |   |               |
| Chrom Iron             |      |   | 1.71          |
| Protosulphuret of Iron |      |   | 5.72          |
| Soluble silicate       |      |   | 45.08         |
| Insoluble „            |      |   | 37.51         |
|                        |      |   | <u>100.06</u> |

The soluble silicate gave in 100 parts:

|                  |               |
|------------------|---------------|
| Silica           | 39.46         |
| Protoxyd of Iron | 22.05         |
| Magnesia         | 38.49         |
|                  | <u>100.00</u> |

Of the undecomposed silicate he gives no determination, only that it is a silicate of alumina, oxyd of Iron, magnesia and Alkali. The analysis is not sufficiently complete.



|                                         |              |
|-----------------------------------------|--------------|
| Magnesian portion                       |              |
| Iron                                    | 2.36         |
| Nickel                                  | 1.56         |
| Phosphuret of Iron                      | 1.05         |
| Sulphur                                 | 0.5          |
| Chrom Iron                              | 1.51         |
| Protosulphuret of Iron                  | 5.72         |
| Soluble silicate                        | 45.08        |
| Insoluble                               | 37.51        |
|                                         | <hr/> 100.00 |
| The soluble silicate gave in 100 parts: |              |
| Silica                                  | 39.48        |
| Protoxyd of Iron                        | 22.05        |
| Magnesia                                | 38.49        |
|                                         | <hr/> 100.00 |

Of the undecomposed silicate he gives no determination, only that it is a silicate of alumina, oxyd of iron, magnesia and Alkali. The analysis is not sufficiently complete.

|                  |             |
|------------------|-------------|
| Iron             | 1.7         |
| Magnesia         | 38.4        |
| Alkali           | 17.8        |
| Protoxyd of Iron | 22.1        |
| Silica           | 39.5        |
|                  | <hr/> 100.0 |

And first to remark that the analysis of the 48. for the silicate part is not complete as the silicate is not determined. The analysis is not sufficiently complete. The analysis is not sufficiently complete.



## CHRONOLOGICAL ARRANGEMENT OF STONE METEORITES.

Chladni in collecting the early history of meteorites, traces them as far back as the seventh century before Christ; and from the writings of Livy, Pliny, Cicero, Plutarch and other ancient historians he has given over twenty meteorites previous to the Christian Era. But as such accounts from those early times are not wholly certain, I shall only enumerate from the latter epoch.

I to 333 Between these dates there were five distinct falls of meteorites.

452 Three large stones fell in Thrace.

570 A shower of stones fell in Bender, Arabia.

616 Several meteorites fell in China.

650 and 837 The place is not given for these two dates but probably in Italy, as the account is in latin.

856. Five stones fell in Egypt during the winter.



- 886 or 839 A meteorite fell in Japan.
- 892 or 897 A meteorite fell at Ahmendabad in India.
- 921 A very large stone fell at Narni, Italy.
- 925 A stone fell in China.
- 952 Near Augsburg, in Bavaria fell a stone.
- 956 Many large stones fell in Italy.
- 963 A shower of stones fell in Italy.
- 898 Two stones fell at Magdeburg in Prusia.
- 1020 or 1021 A large shower of stones fell in Africa  
and many persons and animals were killed.
- 1057 Many large stones fell in Hoanglie, China.
- 1112 A meteorite fell at Aquileia, Trieste.
- 1187 June 30 A shower of stones fell at Mons in France  
The weight of the pieces exceeded a pound.
- 1135 or 1136 Several stones fell at Oldisleben, Germany.
- 1198 A meteorite fell near Paris in France.
- 1164 A shower of stones at Misnia, Saxony.
- 1197 A number of stones fell in Italy.
- 1198 In July a number of stones fell at Tremblaco, Italy.
- ? During the 13th century there was a fall at  
Würzburg, Germany and at Welixos, Russia.



1249 July 26 A shower of stones fell at Quedlinburg Saxony.

1280 A stone fell at Alexandria in Egypt.

1300 Several large stones fell at Arragon in Spain.

1304 Oct. 1 A stone fell in Friedland, Saxony.

1305 A meteorite fell at Vandals, Austria.

1328 Jan. 9 A meteorite fell in Mortahiah and Bakhalia.

1339 July Over one hundred stones fell in Silesia.

1379 May 26 A stone fell in Münden, Hannover.

1421. A stone fell on the island Java.

1438 A shower of stones fell at Burgos, Spain.

1440 A stone fell near Aidin, Asia - Minor.

1474 Two large stones fell at Viterbo, Italy.

1480 A stone fell in Saxony or Bohemia

1491 March 22 A stone fell at Crema, Italy.

1492 Nov. 7 A stone fell at Ensisheim, France, its

weight was 270 lbs. Sp. gr. 3.50. This stone

has an interesting history since its fall. (See Voigt's

Magazin für Naturkunde B. 7. p. 239 and Gilb. Ann. 18. 289.)

Analysed by Fourcroy and Vanquelin.

$\text{SiO}_2$  56  $\text{Fe}_2\text{O}_3$  30.12  $\text{MgO}$  12  $\text{Ni}$  2.4  $\text{S}$  3.5  $\text{CaO}$  1.4

(Jour. de Physique Mar. 1840.)

1496 Jan. 28 A meteorite fell at Cesena, Italy.



- 1510 A meteorite is said to have fallen at Padua, Italy.
- 1511 in Sept. A large shower of stones fell at Crema, Italy.
- 1516 A meteoric stone fell in China and a number of the fragments were saved.
- 1520 May A stonefall occurred at Arragon from which there were three found.
- 1528 On St. Peters and St. Pauls day was a shower of stones.
- 1545 A stone meteorite fell at Piedmont, Italy.
- 1540 Apr. 28 A stone fell at Limousin, France.
- 1552 May 19 A meteorite, probably stone fell at Thuringia in Saxony.
- 1559 Several stones fell at Miscoz, Transylvania.
- 1561 May 17 One stone fell at Eilenborg, Prussia.
- 1564 March 1st A stone fell near Brussels.
- 1580 May 27 Several stones fell at Nörten, Hannover.
- 1581 July 16 One stone fell in Thuringia, Germany.
- 1583 Mai 2 A stone fell at Piedmont, Italy.
- 1587 Jan. 9 A stone weighing 30 lbs fell at Rosas or Cartrovillari, Italy.
- 1591 June 9 A stone meteorite fell at Kunnersdorf Germany.



- 1596 Mar 1st A stone meteorite fell at Crevalcon  
Piedmont.
- 1618 August Three large stones of 100 lbs each fell  
at Murakoz Styria.
- 1622 Jan. 10 A stone fell at Devon, England.
- 1627 Nov. 27 A stone weighing 59 lbs fell at Pro-  
vence, France.
- 1628 Aug. 9 A stone fell at Berkshire, England.
- 1634 Oct. 27 Two stones fell at Charolmois, France.
- 1635 Jun. 21 A large stone passed as a meteor from  
north to south and fell at Vago, Italy.
- 1635 July 7 A small stone fell at Calce, Italy.
- 1636 Mar 6 A large stone fell at Sagau, Prussia.
- 1639 Nov. 29 A stone weighing 38 lbs fell at Mt.  
Vaison, France.
- 1642 Aug. 4 A stone weighing 4 lbs fell in Suffolk,  
England.
- 1647 Feb. 18 A stone fell near Zwickau, Saxony.
- 1647 August A stone fell at Stoltzenau, Germany.
- 1650 Aug. 6 A stone fell at Dordrecht, Holland.
- 1650 Sep. 4? A stone fell at Milan, Italy.



1654 Mar. 30. A shower of stones fell on Funen Island, Denmark.

1668 Jun. 20 A number of large stones fell at Verona, Italy.

1671 Feb. 27 A shower of stones fell in Swabia, Austria.

1673 A stone meteorite fell at Dietting, Bavaria.

1674 Oct. 6 A stone fell in Glarus Canton, Switzerland.

1676 A stone fell in a boat at Orkneys, Scotland.

1677 May 28 Several stones fell at Ermendorf, Saxony.

1680 May 18 Several stones fell near London, England.

1683 Jan 12 A stone fell at Castrovillari, Italy.

1683 Mar. 3 A stone fell at Piedmont, Italy.

1692 — A stone fell at Temesvar, Hungary.

1697 Jan. 13 Several stones fell near Sienna, Italy.

1698 May 16 A stone fell at Bern, Switzerland.

1700 In Autumn A stonefall occurred at Jamaica, West Indies.

1715 Apr. 11 A stone fell near Gartz, Pomerania, Prussia.

1717 Jan. — A stone fell at Larissa, Macedonia.

1723 Jun. 22 A shower of stones at Reichstadt, Bohemia.



1725 July 3 A stone weighing 20 lbs fell at Mixbourg, England.

1727 July 22 Several stones fell at Lilaschitz, Bohemia.

1738 Aug. 18 A stone fell at Carpentras, France.

1740 Oct. 25 Several stones fell at Rasgrad, Hungary.

1740 In winter A large stone fell in Greenland.

1750 Oct. 12 A large stone fell at Niort, Normandy, France.

1752 Jun. 5 Several stones fell at Freisingen, Bavaria.

1753 July 3 Several stones fell at Tabor, Bohemia, one of them quite large. It has a dark matted crust within, a bluish gray color, is very compact and contains many round particles of metallic iron. Sp. gr. 4.28.

Analysed by Howard and Bournon.

In the metallic part 14 parts gave 12.5 iron 1.5 nickel. The unmagnetic part gave in 55 grains silica 25, magnesia 9.5, peroxyd of iron 23.5, and nickel 1.5.

(Philos. transact. 1802.)

1753 Sept. 7. Two stones ( $31\frac{1}{2}$  lbs) fell near Liponas, France. The ground mass is dark ash gray mixed with many black particles. Contains metallic iron and has a dull black crust. (Gilb. Ann. B. 13. p. 343.)

1755 July — A stone ( $7\frac{1}{2}$  lbs) fell near Terranova in Calabria. (U. F. M. p. 248.)

1766 July — A stone fell near Alboreto, Italy.



The inner mass was like sand stone and surrounded by a dark crust. (U. F. M. p. 250.)

1766 Aug. 15 A stone is supposed by some to have fallen at Novallara, Italy, but it is some what doubtful. (U. F. M. p. 251.)

1768 Sep. 13 A meteoric stone ( $7\frac{1}{2}$  lbs) fell near Lucé, France, was broken in pieces by the explosion. The ground mass has a light gray color; with many rust spots. It contains metallic iron and particles of magnetic pyrites, and has a dull black crust. Sp. gr. 3.45. (U. F. M. p. 251.)

1768 Nov. 20 A meteoric stone (36 lbs) fell near Mauerkirchen in Austria. It was broken in two pieces. The ground mass has a light color, nearly white, is very loose in texture and but little metallic iron perceptible, much magnetic pyrites. Sp. gr. 3.45. It has a thick brown black crust.

Analysed by Imhof.

| Fe   | Ni  | Fe <sup>2</sup> O <sup>3</sup> | CaO   | SiO <sup>3</sup> | S + loss |
|------|-----|--------------------------------|-------|------------------|----------|
| 2.33 | 1.2 | 40.24                          | 28.75 | 25.4             | 2.08     |

(Gilb. Ann. B. 15. p. 316.)

1773 Nov. 17 A stone (9 lbs) fell near the village Sena in Spain. It is characterized by a porous structure. It has a dark gray color and brown rust spots. Much metallic iron and a little magnetic pyrites. Sp. gr. 3.63.

Analysed by Proust.

Magnetic part. 90 iron 3 nickel 7 silicates.

Unmagnetic part SiO<sup>3</sup> MgO FeO FeS

66 21 5 12

(Jour. de Physique vol. 60.)



1775 Sep. 19. A stone ( $6\frac{1}{2}$  lbs) fell near Rodach in Koburg, Germany. It had a thin black crust.

(Gilb. Ann. B. 23.)

1775 or 1776 Several stones fell at Obruteza in Volhynien, Russia, one was hung up in the church.

(Gilb. Ann. vol. 31.)

1776 or 1777 In Jan. or Feb. Several stones fell near Fabbriano in Sanatoglia, Italy. (U. F. M. p. 255.)

1779 — A small stone ( $6\frac{2}{3}$  lbs) fell near Pettiswood, West-Meach, Ireland. The inner mass was like white sand stone, contained metallic iron and had a brown crust.

(U. F. M. p. 255.)

1780 April 11. A stone is reported to have fallen near Beeston in England.

(U. F. M. p. 256.)

1782 — A large meteoric stone fell near Turin, Italy. It was white and resembled burnt lime. It sunk 8 feet in the soil.

(U. F. M. p. 256.)

1785 Feb. 19. A stone fell near Eichstädt, Bavaria. Two pieces were found weighing 6 lbs. It is very compact in structure, of a dark bluish gray color with rust spots. Many small globules of metallic iron and has a dull black crust. Sp. gr. 3.65.

Analysed by Klaproth.

| Fe | Ni   | Fe <sup>2</sup> O <sup>3</sup> | Mg O  | Si O <sup>3</sup> | S + loss |
|----|------|--------------------------------|-------|-------------------|----------|
| 29 | 2.50 | 16.50                          | 21.50 | 37                | 4.50     |

(Gilb. Ann. B. 13.)

1787 Oct. 1. Several stones fell in Charkow, Russia. The inner mass is light ash gray and granulated



in structure; contains metallic iron and has a crust which in places is glassy.

Analyses.

| Schnaubert | Fe    | Ni   | SiO <sup>3</sup> | MgO   | Mn <sup>2</sup> O <sup>3</sup> |         |
|------------|-------|------|------------------|-------|--------------------------------|---------|
|            | 21.78 | 1.60 | 48.00            | 22.05 | 6.00                           | = 99.43 |
| Scherer    | 19.80 | 1.5  | 51.00            | 20.50 | 4.20                           | = 97.00 |

(U. F. M. p. 257.)

1789 Aug. 20. In France the locality not given. A large stone fell which measured 15 inches in diameter.

(Phil. Mag. 4 Se. Vol. 8 p. 458.)

1790 July 24. Several stones fell near Barbotan France. The heaviest weighed 20 lbs; has a dark gray color, very compact, much metallic iron and some magnetic pyrites, is surrounded by a dull black crust. Sp. gr. 3.62.

(Gilb. Ann. B. 13.)

1791 May 17. A stone fell near Castel-Berardenga in Toscana Italy.

(U. F. M. p. 260.)

1791 Oct. 20. Several stones fell near Menabilly Cornwall, England.

(U. F. M. p. 261.)

1794 June 16. Twelve small stones fell near Siena Tuscany. They have a light gray color with brown rust spots. A part is granulated in structure and the whole much resembles porphury. They contain a small quantity of metallic iron and much magnetic pyrites, and have a dull black crust. Sp. gr. 3.40.

Analysed by Klaproth.

| SiO <sup>3</sup> | CaO   | Fe   | Ni   | FeO   | Mn <sup>2</sup> O <sup>3</sup> | S + loss |
|------------------|-------|------|------|-------|--------------------------------|----------|
| 44.00            | 22.50 | 2.25 | 0.60 | 25.00 | 0.25                           | 5.40     |

(Gilb. Ann. B. 6.)



1795 Apr. 13. Many stones fell on the island Ceylon, India. They had something the appearance of lava with a pearl gray color, partly granulated and partly crystallized and have a thick black crust. They are very heavy and probably contain much iron.

(U. F. M. p. 262.)

1795 Dec. 13. A large stone (56 lbs) fell near Woldcottage, Yorkshire, England. It has a light gray color with brown rust spots, granular in structure, much metallic iron and magnetic pyrites. Crust black and in places glassy. Sp. gr. 3.85.

Analysed by Howard.

Magnetic portion 76.46 Iron 11.77 Nickel 11.77 Silicates.

Unmagnetic port.  $\text{SiO}_3$   $\text{MgO}$   $\text{Fe}^2\text{O}_3$   $\text{Ni}$

50.00 24.33 32.00 1.34

(Phil. Trans. 1802.)

1796 Jan. 4. A large stone fell near Bélaja-Zerkwa, Russia. It was in a melted or plastic condition when it first fell but on cooling had the general appearance of meteoric stones.

(Gilb. Ann. vol. 35.)

1796 Feb. 19. A stone (10 lbs) fell near Friego, Portugal.

1796 Mar 8. A meteoric stone fell at Lusatia, Saxony.

1798 Mar. 12. A large stone meteorite (20 lbs) passed through the air from west to east and fell at Salés, France. Color light gray passing into brown. Some greenish and some grayish white granulations



much metallic iron and has a rough matted crust.

Sp. gr. 3.45.

Analysed by Vauquelin.

| SiO <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | MgO | Ni   | CaO  |
|------------------|--------------------------------|-----|------|------|
| 46.00            | 38.00                          | 15  | 2.00 | 2.00 |

(U. F. M. p. 265.)

1798 Dec. 13. A shower of stones fell at Benares East India. They had a light gray ground mass mixed with many fine grains of a greenish color. A small quantity of metallic iron is present, and they have a dull black crust. Sp. gr. 3.36. Howard separated the different minerals and gave the analyses separate. The sulphurets contain S 14.3 Fe 75 Ni 0.7 The metallic part Fe 72 Ni 28. The greenish particles SiO<sup>3</sup> 50 MgO 15 Fe<sup>2</sup>O<sup>3</sup> 34.00 NiO 2.5. In the remaining part SiO<sup>3</sup> 48. MgO 18 Fe<sup>2</sup>O<sup>3</sup> 34 NiO 25.

(U. F. M. p. 267.)

1799 April 5. A meteoric stone fell at Baton Rouge, Louisiana. U. S. A.

1802 Sep. — Many stones fell on a mountain near lake Loch-Lay in Scotland. Their fall was witnessed by a shepherd.

(Month. Mag. Oct. 1802.)

1803 Oct. 8. A stone (7<sup>1</sup>/<sub>2</sub> lbs) fell near Apt in France. The ground mass is light gray with rust spots; some light colored concretions separated from the mass, much metallic iron and magnetic pyrites. It has a dull black crust. Sp. gr. 3.48.

Analysed by Laugier.

| SiO <sup>3</sup> | FeO   | MgO  | S    | Mn <sup>2</sup> O <sup>3</sup> | Ni   |
|------------------|-------|------|------|--------------------------------|------|
| 34.00            | 38.03 | 14.5 | 9.00 | 0.83                           | 0.33 |

(Ann. d. Musée d'hist. nat. Vol. 23.)



1803 July 4. A stone of a few pounds weight fell at East Norton, England. It tore down a chimney, went through roof and lodged in the pantry, has a dark brow crust. (Phil. Mag. July 1803.)

1803 Dec. 13. Fell a stone ( $5\frac{1}{4}$  lbs) at St. Nicholas on the market pace Massing, is grayish white, porous in structure, also greenish spots of olivine, no metallic iron but some Magnetic pyrites. Sp. gr. 3.26.

Analyzed by Imhof.

| SiO <sub>3</sub> | MgO | Fe <sub>2</sub> O <sub>3</sub> | Ni   | Fe  | Loss  |                     |
|------------------|-----|--------------------------------|------|-----|-------|---------------------|
| 31               | 23  | 32.54                          | 1.35 | 1.8 | 10.06 | (Gilb. Ann. B. 18.) |

1803 April 26. Fell the greatest shower of meteorites yet known on record at L'Aigle, France. About 3000 were numbered. The ground mass partly light, partly dark, also light brown spots, porphyritic in appearance, much metallic iron, A small ammount of Magnetic pyrites. Sp. gr. 3.95.

Analyzed by Vauquelin and Thenard.

|           | SiO <sub>3</sub> | Fe <sub>2</sub> O <sub>3</sub> | MgO | Ni | S | CaO |
|-----------|------------------|--------------------------------|-----|----|---|-----|
| Vauquelin | 53               | 36                             | 9   | 3  | 2 | 1   |
| Thenard   | 46               | 45                             | 10  | 2  | 5 | —   |

(U. F. M. p 269.)

1804 April 5. A small stone fell near Glasgow, Scotland; light gray ground mass mixed with light brown spots and black particles. Some metallic iron and Magnetic pyrites, crust dark and matted. Sp. gr. 3.53. (Tillocks Phil. Mag. May. 1804.)

1805 Mar. 25. Two stones ( $7 + 2\frac{1}{2}$  lbs) fell at Irkutsk, Siberia; dark gray ground mass with brown



spots, very compact, much metallic iron, and a little Magnetic pyrites, crust dull black. Sp. gr. —

Analysed by Scherer.

| SiO <sub>3</sub> | MgO  | Cr   | Fe    | Al <sup>2</sup> O <sup>3</sup> | Ni    | CaO  | MgO  | S     |
|------------------|------|------|-------|--------------------------------|-------|------|------|-------|
| 40.50            | 1.25 | 2.00 | 18.50 | 3.25                           | 10.00 | 6.25 | 9.00 | 8.12. |

(U. F. M. p. 267.)

1805 June. Several stones fell at Constantinople, Turkey. A gray homogeneous mass and contains no metallic iron, has a black glassy crust. Sp. gr. 3.17.

(Jour. des Mines vol. 23.)

1805. Nov. A stone fell at Asco on the Island Corsica. Light gray ground mass with brown spots contains not a small quantity of metallic iron and some Magnetic pyrites. Sp. gr. 3.66.

(D. M. p. 26.)

1806 Mar. 15. Two stones (12 lbs) fell at Alais, France. Nearly black, easily broken and pulverized, no metallic iron or magnetic pyrites. Sp. gr. 1.70.

Analyzed by Thenard.

| SiO <sub>3</sub> | FeO | NiO | Mn <sup>2</sup> O <sup>3</sup> | C   | MgO | S   | Cr | HO + Loss |
|------------------|-----|-----|--------------------------------|-----|-----|-----|----|-----------|
| 21               | 40  | 2.5 | 2                              | 2.5 | 9   | 3.5 | 1  | 18.5      |

Afterwards analyzed by Vauquelin.

| SiO <sub>3</sub> | FeO | MgO | Ni | Mn <sup>2</sup> O <sup>3</sup> | Cr <sup>2</sup> O <sup>3</sup> | C   | S     | Loss |
|------------------|-----|-----|----|--------------------------------|--------------------------------|-----|-------|------|
| 30               | 38  | 14  | 2  | 2                              | 2                              | 2.5 | trace | 9.2  |

(U. F. M. p. 279)

Berzelius has also analyzed this stone (Pogg. vol. 33.)

and gives:

|                               |       |               |
|-------------------------------|-------|---------------|
| Black burnt Residuum          | (a) = | 88.146        |
| Gray brown sublimed substance | (b) = | 0.944         |
| Carbonic acid                 | (c) = | 4.328         |
| Water                         | (d) = | 6.582         |
|                               |       | <hr/> 100.000 |



(a) weighed 1.382 gram. and contained:

| SiO <sub>3</sub>            | MgO    | CaO    | FeO    | NiO    | MnO    | Al <sup>2</sup> O <sup>3</sup> | FeOCr <sup>2</sup> O <sup>3</sup> |
|-----------------------------|--------|--------|--------|--------|--------|--------------------------------|-----------------------------------|
| 0.4315                      | 0.3070 | 0.0132 | 0.4011 | 0.0190 | 0.0036 | 0.0325                         | 0.0087                            |
| SnO    Resid.    Loss       |        |        |        |        |        |                                |                                   |
| 0.0110    0.1200    0.0640. |        |        |        |        |        |                                |                                   |

1806 May 17. A stone (2½ lbs) fell at Glastonbury, England. It has a metallic appearance on its surface.

(Month. Mag. Apr. 1811.)

1807 Mar. 13. fell a large stone (160 lbs) at Timochin, Somolensk, Russia; an ash gray color with many brown spots, much metallic iron and magnetic pyrites. A dark thick matted crust. Sp. gr. 3.60.

Analyzed by Scherer.

| SiO <sub>3</sub> | MgO | Fe    | FeO   | Ni   | S + Mn + Loss |
|------------------|-----|-------|-------|------|---------------|
| 39               | 20  | 17.25 | 17.50 | 1.25 | 4.50.         |

(U. F. M. p. 281.)

1807 Dec. 14. A large number of stones (300 lbs) fell at Weston, Conn. U. S. A. The ground mass a mixture of light and dark gray materials also rust brown spots, metallic iron and magnetic pyrites. A very rough, matted crust. Sp. gr. 3.50.

Analyses from Warden and from Silliman.

|          | SiO <sub>3</sub> | Fe <sup>2</sup> O <sub>3</sub> | MgO  | CaO | Al <sup>2</sup> O <sub>3</sub> | CrO <sub>3</sub> | S    | Mn <sup>2</sup> O <sub>3</sub> | Loss |
|----------|------------------|--------------------------------|------|-----|--------------------------------|------------------|------|--------------------------------|------|
| Warden   | 4.1              | 30                             | 16   | 3   | 1                              | 2.33             | 2.33 | 1.33                           | 3    |
|          | SiO <sub>3</sub> | Fe <sup>2</sup> O <sub>3</sub> | MgO  | NiO | S                              |                  |      |                                |      |
| Silliman | 51.5             | 38.0                           | 13.0 | 1.5 | 1.                             |                  |      |                                |      |

(Am. J. sc. vol. 37 and 25. vol. 6.) (Ann. de Chimie vol. 73.)

1808 — A stone is reported to have fallen at Moradabad, India.



1808 Apr. 19. A large number of stones fell at Parma, Italy. Light gray ground mass, somewhat granulous, contain metallic iron, and magnetic pyrites. black crust in some places matted and in others glassy. Sp. gr. 3.40.

Analyzed by Guidotti.

| SiO <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | MgO | NiO | Mu <sup>2</sup> O | <sup>3</sup> Cr <sup>2</sup> O <sup>3</sup> | S |
|------------------|--------------------------------|-----|-----|-------------------|---------------------------------------------|---|
| 50               | 28                             | 19  | 2.5 | 1.5               | 1                                           | 4 |

(U. F. M. p. 289.)

1808 May 22 About 250 stones fell at Stannern, Moravia. The ground mass a mixture of white mineral and greenish black, contains no metallic iron, has a glassy crust. Sp. gr. 3.15.

Analyses from Klaproth, Moser and Vauquelin.

|     | SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | CaO   | MgO  | FeO | S + Mn <sup>2</sup> O <sub>3</sub> + Loss |
|-----|------------------|--------------------------------|-------|------|-----|-------------------------------------------|
| K = | 48.25            | 14.50                          | 9.50  | 2    | 23  | 2.25                                      |
| M = | 46.25            | 7.62                           | 12.11 | 2.50 | 27  | 4.41                                      |
| V = | 50.00            | 9.00                           | 12.00 |      | 29  | 1                                         |

(U. F. M. p. 288.)

Afterwards analyzed by Rammelsberg.

By H. Cl. decomposed 34.98 = A.

„ „ not decomposed 65.02 = B.

Analysis of the whole = C.

|     | SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | MnO  | CaO                            | MgO  | NoO  |
|-----|------------------|--------------------------------|--------------------------------|------|--------------------------------|------|------|
| A = | 46.19            | 31.26                          | 2.93                           | —    | 16.98                          | 1.12 | 1.14 |
| B = | 49.44            | 2.64                           | 28.31                          | 1.25 | 8.20                           | 9.97 | .35  |
| C = | 48.30            | 12.65                          | 19.32                          | .81  | 11.26                          | 6.87 | .62  |
|     |                  |                                | KoO                            | FeO  | Cr <sup>2</sup> O <sup>3</sup> |      |      |
|     |                  |                                | .50                            | —    |                                |      |      |
|     |                  |                                | .10                            | .83  |                                |      |      |
|     |                  |                                | .23                            | .54  |                                |      |      |

(Pogg. Ann. B. 83.)

1808 Sep. 3. Several small stones fell at Lissa



Bohemia, light gray, finely granulated ground mass, rather large quantity of metallic iron, and magnetic pyrites, a dark matted crust. Sp. gr. 3.50.

Analyzed by Klaproth.

| SiO <sub>3</sub> | Fe | Ni   | Mn <sup>1</sup> O <sub>3</sub> | MgO | Al <sup>2</sup> O <sub>3</sub> | CaO  | S + Loss |
|------------------|----|------|--------------------------------|-----|--------------------------------|------|----------|
| 43               | 29 | 0.50 | 0,25                           | 22  | 1.25                           | 0.50 | 3.50     |

(Gilb. Ann. B. 32.)

? 1809 June 17. A stone fell on the deck of a ship near Block Island and at the same time several were heard to fall in the water. It has nearly the color of iron.

(U. F. M. p. 290.)

1809 — A stone fall occurred at Kikina, Russia.

1810 Jan. 30. A stone (3 lbs) fell at Caswell N. Carolina (U. S. A.) is dark brown and very porous, contains metallic iron, and is itself a magnet having two poles.

(U. F. M. p. 291.)

1810. July. A large stone meteorite fell at Fulty-Chur, India; and it is yet there to be seen.

(U. F. M. p. 292.)

1810 August — A stone (7 lbs) fell at Lipperary, Ireland. Bluish gray ground mass with some small rust spots, much metallic iron, and magnetic pyrites. A dark thick matted crust. Sp. gr.

Analyzed by Higgins.

| SiO <sub>3</sub> | Fe | MgO | S | Ni   | sum    |
|------------------|----|-----|---|------|--------|
| 48.25            | 39 | 9   | 4 | 1.75 | = 102. |

(Gilb. Ann. B. 60.)

1810 Nov. 23. Two stones (40 + 20 lbs) fell at Charsonville, France. Bluish gray ground mass with many rust spots, very compact and coherent in structure.



Contains metallic iron and magnetic pyrites. A dull black crust. Sp. gr. 3.71.

Analyzed by Vauquelin.

| SiO <sup>3</sup> | Fe   | MgO  | Al <sup>2</sup> O <sup>3</sup> | CaO | Cr  | Mn <sup>2</sup> O <sup>3</sup> | Ni | S | Loss |
|------------------|------|------|--------------------------------|-----|-----|--------------------------------|----|---|------|
| 38.4             | 25.8 | 13.6 | 3.6                            | 4.2 | 1.5 | 0.6                            | 16 | 5 | 1.3  |

(Gilb. Ann. B. 37 und 40.)

1811 Mar. 12. In the night fell a stone (13 lbs) at Poltawa, Russia. Light ash gray, very compact ground mass, much metallic iron in small and large globules and many small particles of magnetic pyrites. Crust somewhat glassy. Sp. gr. 3.47. (D. M. — Gilb. Ann. B. 38.)

1811 July 8. Three stones (6 lbs) fell at Berlanguilaz, Spain. Light gray ground mass with rust spots, contain much metallic iron and some magnetic pyrites, have a dull black crust. Sp. gr. 3.49.

(Bibliot. britannique vol. 13.)

1812 April 10. Several small stones fell near Toulouse, France. A dark gray ground mass with rust spots, much metallic iron and magnetic pyrites. A dull black crust with the surface raised in spots like small blisters. Sp. gr. 3.70. (D. M.) (Bibl. britan. vol. 50.)

1812 April 15. Two small stones (4½ lbs) fell at Erxleben, Saxony. Dark ash gray homogeneous ground mass, much metallic iron in small globules and fine particles of magnetic pyrites, a thin, dull, black crust. Is characterised by its compact structure. Sp. gr. 3.63.

Analyzed by Klaproth, and also by Stromeyer.



|          | SiO <sub>3</sub> | Fe    | Ni   | Cr <sup>2</sup> O <sup>3</sup> | MnO | MgO   | Al <sup>2</sup> O <sup>3</sup> | CaO  |
|----------|------------------|-------|------|--------------------------------|-----|-------|--------------------------------|------|
| K =      | 39.50            | 31    | 0.25 | 1                              | .25 | 26.50 | 1.25                           | 0.50 |
| S =      | 36.32            | 24.41 | 1.58 | .24                            | .70 | 23.58 | 1.60                           | 1.92 |
| S + Loss |                  | FeO   | NaO  |                                |     |       |                                |      |
|          | 3.74             | 5.57  | 0.74 |                                |     |       |                                |      |
|          | 2.95             | 0.358 |      |                                |     |       |                                |      |

Gilb. Ann. B. 42. — U.F.M. p. 300.)

1812 Aug. 5. A large stone (69 lbs) fell at Chantonay, France. Is dark gray and compact, has the appearance of basalt, some brown spots, contains metallic iron and also magnetic pyrites, has a dull black crust. Sp. gr. 3.46.

Analysis by Berzelius, only the unmagnetic part. with H.Cl it gave decomposed silicat 51.12 = A.  
undecomposed „ 48.88 = B.

|     | SiO <sup>3</sup>               | MgO    | FeO                               | MnO   | NiO   | NaO + KO |                     |
|-----|--------------------------------|--------|-----------------------------------|-------|-------|----------|---------------------|
| A = | 32.607                         | 34.357 | 28.801                            | .0821 | 0.456 | 0.977    |                     |
| B = | 56.252                         | 20.396 | 9.723                             | 0.690 | .138  | 1.000    | 0,512               |
|     | Al <sup>2</sup> O <sup>3</sup> | CaO    | Cr <sup>2</sup> O <sup>3</sup> Fe |       |       |          |                     |
|     | —                              | —      | —                                 |       |       |          |                     |
|     | 6.25                           | 3.106  | 1.100                             |       |       |          | (Pogg. Ann. B. 33.) |

1813. Mar. 14. fell several stones and much dust.  
At Cutro, Italy. (Biblioth. Britan. Oct. 1813.)

1813. Sep. 11. A meteorite surrounded with smoke passed nearly horizontal from east to west, eleven explosions were heard and three stones (65 + 17 + 24 lbs) fell near Limerick, Ireland. They have a dark gray ground mass with rust spots contain metallic iron and magnetic pyrites, have a dull black crust. Sp. gr. 364. (Tillocks Mag. May 1818.) (D. M.)

1813. Dec. 13. Several stones fell as Lontalax.



Finland. Light gray ground mass, highly granulated structure and little power of cohesion. Many small grains of Olivine, contains no metallic iron. Have a glassy crust. Sp. gr. 3.07.

Analysis by Berzelius.

With HCl it gave decomposed silicate 93.55 = A  
undecomposed „ 6.45

|     |                   |        |        |      |                                |
|-----|-------------------|--------|--------|------|--------------------------------|
|     | Si O <sup>3</sup> | MgO    | FeO    | Mn O | Al <sup>2</sup> O <sup>3</sup> |
| A = | 37.411            | 32.922 | 28.610 | .793 | 0.264                          |

(D M. — Pogg. vol. 33.)

1814. Feb. 3. A large stone (40 lbs) fell at Bachmut, Russia. Light ash gray ground mass, partly granulated and has a few small spots. A small quantity of metallic iron and a usual quantity of Magnetic pyrites. Sp. gr. 3.42.

Analysis by Prof. von Giese.

|                   |     |                                |    |     |    |                                |     |
|-------------------|-----|--------------------------------|----|-----|----|--------------------------------|-----|
| Si O <sup>3</sup> | MgO | Al <sup>2</sup> O <sup>3</sup> | Fe | Ni  | Mn | Cr <sup>2</sup> O <sup>3</sup> | + S |
| 44.               | 18  | 3                              | 21 | 2,5 | 1  | 1                              |     |

(Gilb. Ann. vol. 50.)

1814. Mar. — Several stones fell near Sawotaiola in Finland, in a small lake which was then covered with ice. In the spring they were found.

(U. F. M. p. 309.)

1814. Sept. 5. Two stones (one of 18 lbs) fell near Agen, France. Light gray ground mass with reddish brown spots, and many small black particles. Contains metallic iron, and very fine Magnetic pyrites. The crust dull black and in places drossy.

(Jour. d. Phys. Sep. 1814.)



1814. — A large stone (112 lbs) fell at Saros in Hungary. (Phil. Mag. 45. vol. 8. p. 459.)

1814. Nov. 5. A shower of 25 stones fell at Voab. East India. (Tillock's Mag. Aug. 1815.)

1815. Feb. 18. A large (25 lbs) stone fell at Door-alla near Loodianah in East India.

(Rep. of the Brit. Ass. f. 1850.)

1815. Oct. 3. There fell 60 small stones (8 lbs) near Chassigny, France; have a yellowish green ground mass, granulous in structure, contains black particles of chrom iron or magnetic iron. Have no metallic iron and no Magnetic pyrites. The crust is thick, dull black and smooth. Sp. gr. 3.65. (U. F. M. p. 307.)

Analyzed by Vauquelin.

|                   |     |                                |    |                            |
|-------------------|-----|--------------------------------|----|----------------------------|
| Si O <sup>3</sup> | MgO | Fe <sup>2</sup> O <sup>3</sup> | Cr |                            |
| 339               | 32  | 31                             | 2  | (Ann. d. Chim. Jan. 1816.) |

1816. — A stone fell into a house at Glastonburg, England. As it was thrown out of the house it was quite warm and smelt of sulphur. (U. F. M. p. 309.)

1816. — Near Nagy Banga in Hungary a stone is reported to have fallen. (Phil. Mag. 45. vol. 8. p. 259.)

1818. Mai 30. A meteoric stone fell near Zabor-ezika, Russia. Has a light ash gray ground mass, with some small rust spots, many small black particles of magnetic iron. Metallic iron scarcely to be seen.

Sp. gr. 3.40.

Analyzed by Langio.

|                  |                                |       |                                |      |      |      |      |         |          |
|------------------|--------------------------------|-------|--------------------------------|------|------|------|------|---------|----------|
| SiO <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | MgO   | Al <sup>2</sup> O <sup>3</sup> | Ni   | CaO  | Cr   | S    | KuO+MnO | sum      |
| 41.00            | 45.00                          | 14.30 | 0.75                           | 1.00 | 2.00 | 0.75 | 4.00 | Trace   | = 1.0340 |

(Ann. des Min. vol. 9.)



1818. Feb. 15. A stone is reported to have fallen at Limoges France, but it is not altogether certain.

(Phil. Mag. 4. S. vol. 8. p. 459.)

1818. June — A meteoric stone (15 lbs) fell at Seres Macedonia, Turkey. The ground mass is bluish gray with some round spots of a light color, is very compact in structure, contains much metallic iron, and finely intermixed Magnetic pyrites. A dull black crust. S. p. gr. 3.70.

Analyzed by Berzelius.

|                         |    |              |                     |
|-------------------------|----|--------------|---------------------|
| The magnetic part gave. | Fe | 77.94        | } Nickel iron.      |
|                         | Ni | 4.80         |                     |
|                         | Fe | 10.43        | } magnetic pyrites. |
|                         | S  | 6.83         |                     |
|                         |    | <hr/> 100.00 |                     |

The unmagnetic part gave as silicate decomposed with  
H Cl 47.5 = A.

The unmagnetic part gave as silicate undecomposed with  
52.5 = B.

|      | Si O <sup>3</sup> | Fe O | Fe <sup>2</sup> O <sup>3</sup> | Mg O  | Al <sup>2</sup> O <sup>3</sup> | Ni O | Ca O | Cr <sup>2</sup> O <sup>3</sup> |
|------|-------------------|------|--------------------------------|-------|--------------------------------|------|------|--------------------------------|
| A. = | 28.7              | 29.6 | —                              | 40.0  | —                              | —    | —    | —                              |
| B. = | 49.83             |      | 9.52                           | 14.48 | 5.33                           | 0.19 | 3.54 | 0.95                           |
|      |                   |      | Mn <sup>2</sup> O <sup>3</sup> | Na O  | KO                             |      |      |                                |
|      |                   |      | —                              | 0.9   | 0.8                            |      |      |                                |
|      |                   |      | 4.57                           | 1.47  | 3.22                           |      |      |                                |

(Pogg. Ann. vol. 16. p. 611.)

1818. Aug. 10. A stone (7 lbs) fell at Solobodka, Russia. Light gray ground mass with rust brown spots and dark streaks passing through the mass, has the appearance of a piece of marble. A considerable quantity of metallic iron and some particles of magnetic



pyrites. Crust somewhat glassy in appearance. Sp. gr. 3.47.

(D. M. p. 55.)

1819. June 13. At Jonzac, France, fell several stones, the number and weight not known. The ground mass a mixture of a white and a dark colored mineral. Contains no metallic iron. The crust is glassy. Sp. gr. 3.08.

Analyzed by Laugier.

| SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | CaO  | MgO  | FeO   | Mn <sup>2</sup> O <sup>3</sup> | S    | Cr <sup>2</sup> O <sup>3</sup> | sum      |
|------------------|--------------------------------|------|------|-------|--------------------------------|------|--------------------------------|----------|
| 46.00            | 6.00                           | 7.50 | 1.60 | 36.00 | 2.80                           | 1.50 | 1.00                           | = 102.40 |

(Ann. des Min. vol. 6. — Ann. de Chim. vol. 13.)

(D. M. p. 26.)

1819. Oct. 13. A stone (7 lbs) fell at Politz near Gera South Prusia. Light ash gray groundmass with indistinct rust spots and some black particles. Contains metallic and very little magnetic pyrites. Crust dull black and rather thick. Sp. gr. 3.39.

Analyzed by Stromeyer.

| SiO <sup>3</sup> | MgO   | Al <sup>2</sup> O <sup>3</sup> | FeO  | Mn <sup>2</sup> O <sup>3</sup> | Cr <sup>2</sup> O <sup>3</sup> | Fe    | Ni   | S    | sum     |
|------------------|-------|--------------------------------|------|--------------------------------|--------------------------------|-------|------|------|---------|
| 38.06            | 29.93 | 3.46                           | 4.89 | 1.15                           | 0.13                           | 17.48 | 1.36 | 2.70 | = 99.16 |

(D. M. p. 54. — Ann. des Min. vol. 6.)

1820. July 12. Several stones (14½ lbs) fell at Lixna near Dünenburg, Rusia. Dark gray ground mass, have both white and dark colored grains separated from the mass. Contain metallic iron and magnetic pyrites have a dull black crust. Sp. gr. 3.70.

This meteor was analyzed first by Laugier afterwards by Grotthuss.



|     | SiO <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | MgO | Al <sup>2</sup> O <sup>3</sup> | Ni  | Cr | CaO | S            |
|-----|------------------|--------------------------------|-----|--------------------------------|-----|----|-----|--------------|
| L = | 34               | 40                             | 17  | 1                              | 1.5 | 1  | 0.5 | 6.8 = 101.80 |

|     | FeO  |    |      |    |      |     |     | Fe         |
|-----|------|----|------|----|------|-----|-----|------------|
| G = | 33.2 | 22 | 10.8 | 1. | 2.00 | 0.7 | 0.5 | 3.5 26=100 |

(Ann. des Min. vol. 9. — Ramm. Handw. p. 28.)

1820. Mar. 21. A stone meteorite fell near Vedenburg, Hungary. No full account seems to have been given. (Phil. Mag. 45. vol. 8. p. 459.)

1820. Nov. 29. A shower of stones fell at Cosenza Calabrio, Italy. (Phil. Mag. 45. vol. 8. p. 459.)

1821. June 15. Three stones (one 220 lbs) fell at Juvenas, France. Ground mass a mixture of yellowish white and dark green mineral, and bot han crystalline or at least granulous in structure. Contains only a small quantity of metallic iron. Has a glassy crust. Sp. gr. 3.10.

Analysed by Laugier and by Rammelsberg.

Laugier found.

| SiO <sup>3</sup> | MgO  | CaO  | Al <sup>2</sup> O <sup>3</sup> | FeO   | Mn <sup>2</sup> O <sup>3</sup> | Cr <sup>2</sup> O <sup>3</sup> | CuO  | S    | KO   |
|------------------|------|------|--------------------------------|-------|--------------------------------|--------------------------------|------|------|------|
| 40.00            | 0.80 | 9.20 | 10.40                          | 23.50 | 6.50                           | 1.00                           | 0.10 | 0.50 | 0.20 |

Analysis by Rammelsberg.

|                                            |            |
|--------------------------------------------|------------|
| Analysis of the whole mass together        | A.         |
| Analysis of the part. decomposed by H. Cl. | B. = 36.77 |
| undecomposed                               | C. 63.23   |
|                                            | <hr/> 100. |

|     | SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | FeO   | Fe   | CaO   | MgO  | NaO  |
|-----|------------------|--------------------------------|--------------------------------|-------|------|-------|------|------|
| A = | 49.23            | 12.55                          | 1.21                           | 20.33 | 0.16 | 10.23 | 6.44 | 0.63 |
| B = | 44.38            | 33.73                          | 3.29                           |       |      | 18.07 | 0.36 | 1.03 |
| C = | 52.07            | 0.24                           |                                | 30.81 |      | 5.68  | 9.98 | 0.41 |

|  | KO   | PO <sup>5</sup> | Fi   | Cr   | S                                  |
|--|------|-----------------|------|------|------------------------------------|
|  | 0.12 | 0.28            | 0.10 | 0.24 | 0.09                               |
|  |      |                 |      |      | FeS                                |
|  | 0.33 | 0.54            |      |      | 0.71                               |
|  |      |                 |      |      | Cr <sup>2</sup> O <sup>3</sup> FeO |
|  |      |                 | 0.16 |      | 2.13                               |

(Ann. des Min. B. 8.) (Pogg. Ann. B. 73.)



1822. June 3. Several small stones fell near Angers, France.

The ground mass is a mixture of a white and reddish material. The crust has a dark brown color and in places has been meted. (Gilb. Ann. B. 71.)

1822. Aug. 7. A stone meteorite fell near the village Kadonah, Persia. (Rep. of Brit. Ass. of 1850.)

1822. Sep. 10. A stone meteorite fell at Carlstadt Sweeden. (Phil. Mag. 45. B. 8. p. 459.)

1822. Sep. 13. A single stone fell near La Baffe, Vosges, France. A grayish white groundmass with rust brown spots, finely granulated in structure, contains metallic iron and small particles of magnetic pyrites. Crust mostly dull black but somewhat glassy. Sp. gr. 366.

Analyzed by Vauquelin.

| SiO  | Fe <sup>2</sup> O <sup>3</sup> | CaO + KO | MgO | S   | Cr <sup>2</sup> O <sup>3</sup> | NiO  |
|------|--------------------------------|----------|-----|-----|--------------------------------|------|
| 35.0 | 62.8                           | 12.5     | 4.3 | 2.2 | 0.2                            | 0.50 |

(Ann. des Min. B. 8.)

1822. Nov. 30. At Tuttehpore Hindoostan. Several stones (one of 22 lbs) fell. The meteor was large and bright like the full moon and passed in a N. E. direction. It has a light ash gray color, is quite compact, finely granulated. Sp. gr. 3.35.

(D. M. p. 142.) Proc. Am. Assoc. B. 4.)

1823. Aug. 7. A stone (16 lbs) fell at Nobleboro, Maine, U. S. A. Its description is the same as that from Lontalax only that it is a little less coherent, and more porous in structure. Sp. gr. 3.09.



Analyzed by J. W. Webster.

| SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | CaO   | MgO  | Cr   | Fe   | Ni  | sum     |
|------------------|--------------------------------|-------|------|------|------|-----|---------|
| 29.5             | 4.7                            | Trace | 24.8 | 4.00 | 14.9 | 2.3 | = 98.5. |

Shepard has more recently analyzed the same stone and found neither Nickel nor Sulphur.

(Am. J. Sc. vols 7 and 9.) (Phil. Mag. vol. 63.)

1824. Jan. 15. Three small stones fell at Renosso in Ferrara, Italy. A dull black ground mass with many light colored grains giving it an appearance of Porphyry. Contains metallic iron.

The crust has a little glance and a scaly appearance. Sp. gr. 3.25.

Analyzed by Laugier.

| SiO <sup>3</sup> | FeO   | MgO   | Cr <sup>2</sup> O <sup>3</sup> | NiO  | S    | sum      |
|------------------|-------|-------|--------------------------------|------|------|----------|
| 41.75            | 43.00 | 16.00 | 1.50                           | 1.25 | 1.00 | = 104.50 |

(Pogg. B. 18. — Ann. de Ch. et de Phys. B. 34.)

1824. Oct. 14. A single stone (4 lbs) fell near Zembrak Bohemia. The ground mass a mixture of a light and a dark gray mineral; has many rust brown spots. Contains much metallic iron and magnetic pyrites. The crust is thick. Color dull black. Sp. gr. 3.60.

(D. M. p. 80.)

1824. Feb. 18. A stone (5 lbs) fell at Irkutsch, Siberia. Light gray ground mass, contains metallic iron, is very porous; thin black crust.

(Pogg. Ann. B. 24.) (D. M. p. 142.)

1825. Jan. 16. A stone fell at Oriang. Malwate, India.

(Phil. Mag. 4. S. B. 8. p. 459.)

1825. Feb. 10. A stone (15 lbs) fell at Nanjemoy,



Maryland. (U. S. A.) A mixed gray ground mass, very compact and coherent in structure, with rust brown spots. Contains metallic iron and finely intermixed magnetic pyrites. The crust is rough with a dull black color. Sp. gr. 3.66.

Analyzed by Chilton.

Unmagnetic part = A. Magnetic part = B.

|     | SiO   | Fe <sup>2</sup> O <sup>3</sup> | NiO  | MgO   | CaO  | Al <sup>2</sup> O <sup>3</sup> | S                                      |
|-----|-------|--------------------------------|------|-------|------|--------------------------------|----------------------------------------|
| A = | 59.60 | 24.60                          | 3.20 | 10.40 | 1.80 | 0.20                           | 5.08                                   |
| B = |       | 96.00                          | 5.00 |       |      |                                | Undesolved mineral. 13.84              |
|     |       |                                |      |       |      |                                | (Am. J. sc. B. 9.) (Pogg. Ann. Bd. 8.) |

1825. Sep. 15. Two stones (30 lbs) fell at Orvahn, Sandwich Islands. A light greenish gray ground mass with some spots. Many dark streaks pass through the mass. Contain metallic iron and magnetic pyrites. Crust dull black and in places changed into a brown red. Sp. gr. 3.39. (D. M. p. 51.)

1825. — A stone fell at Oriang in Malwate. East India, which killed a man and injured a woman.(!?) (D. M. p. 142.)

1826. May 19. A stone (86 lbs) fell at Ekatherinosloff, Rusia. Sp. gr. 3.77.

1826. Mar. 15. A stone meteorite fell near Lugano, Italy. (Pogg. Ann. B. 18. p. 185.)

1826. Sep, — A stone fell at Waterville. Maine (U. S. A.) Light gray ground mass, very porous and looks much like pumice stone; has a black glassy crust.



## Analysis by Schepard?

| SiO <sup>3</sup> | FeO  | Al <sup>2</sup> O <sup>3</sup> | MgO  | CaO  | sum      |
|------------------|------|--------------------------------|------|------|----------|
| 70.00            | 8.00 | 18.50                          | 2.59 | 1.30 | = 100.99 |

(Am. J. sc. 25. B. 6.)

1826. a 7. In summer. A stone (3.03) fell at Waterloo Seneca. Co. N. S. (U. S. A.), was found in a bin of wheat in the upper part of a mill, and directly over it was a hole broken through the roof. Its color is redish brown, very loose in texture, easily crumbled with the fingers. Sp. gr. 2, 30.

## Analysis by Schepard.

| SiO <sup>3</sup> | FeO  | Al <sup>2</sup> O <sup>3</sup> | Moisture | CaO + MgO + Loss |
|------------------|------|--------------------------------|----------|------------------|
| 78.80            | 8.72 | 6.28                           | 4.75     | 1.42             |

(Am. J. sc. 25. B. 11.) (Proc. Am. Assoc. Bd. 4.)

1827. Feb. 27. A stone of several pounds fell at Mhow Lazeepore, India. Sp. gr. 3.5.

(Phil. Mag. 45. Bd. 8. p. 459.)

1827. May 9. Three stones (largest 11 lbs) fell as Drake Creek near Nashville. Tennessee (U. S. A.). Light gray ground mass, with some spots containing a small quantity of metallic iron, and much magnetic pyrites. It has a glassy crust. Sp. gr. 3.48.

## Analysis by Silliman.

| SiO <sup>3</sup> | NiO   | MgO    | Al <sup>2</sup> O <sup>3</sup> | Cr <sup>2</sup> O <sup>3</sup> | JeO    | FeO    | S     | Loss  |
|------------------|-------|--------|--------------------------------|--------------------------------|--------|--------|-------|-------|
| 40.000           | 2.166 | 23.833 | 2.466                          | 0.833                          | 12.000 | 12.200 | 2.443 | 4.069 |

Another analysis of this stone has been made by Dr. V. Baumhauer.

(Pogg. Ann. B. 66. p. 498.)

(Am. J. sc. vol. 17 and 18.)



11.496 Nickeliferous iron    Fe    Ni    Co    Sn

85.021    13.001    1.411    0.567

4.846 FeS

Fe

S

62.770    37.230

1.973 FeO. Cr<sup>2</sup>O<sub>3</sub>

FeO

Cr<sup>2</sup>O<sub>3</sub>

30.440    69.560

45.062 Olivine

SiO<sub>3</sub>

MgO

FeO

CaO

MnO

37.845

41.626

13.722

0.679

4.681

Al<sup>2</sup>O<sub>3</sub>

NaO

KO

SnO

0.508

0.783

0.056

0.034

3.722 Labradorite

SiO<sub>3</sub>

CaO

Al<sup>2</sup>O<sub>3</sub>

NaO

53.200

10.593

29.805

6.397

32.901 Hornblende

SiO<sub>3</sub>

MgO

FeO

MnO

Al<sup>2</sup>O<sub>3</sub>

59.176

12.256

9.861

0.611

10.540

NiO + CuO + SnO

7.556.

100.000

1827. Oct. 8. A stone (4 lbs) fell at Bialstock, Russia. Contains no metallic iron. Light gray ground mass, little coherent, is a conglomerate in appearance, has a porous glassy crust. Sp. gr. 3.17. (D. M. p. 27.)

1828. June 4. A single stone (4 lbs) fell near Richmond in Virginia (U. S. A.) A dark gray ground mass mixed with lighter colored particles, also with rust spots. Contains metallic iron and magnetic pyrites. A dull black porous crust and separated easily from the ground mass. Sp. gr. 3.34.

Analysis by Shepard.

A = Unmagnetic part

B = Magnetic part



|     | SiO <sup>3</sup> | MgO   | FeO   | NaO + Cr <sup>2</sup> O <sup>3</sup> | S + Ni |
|-----|------------------|-------|-------|--------------------------------------|--------|
| A = | 42.30            | 31.46 | 20.67 | 5.57                                 |        |

|     | Fe    | Ni   |                                                  |
|-----|-------|------|--------------------------------------------------|
| B = | 93.90 | 6.10 | (Am. J. sc. vol. 15 and 16.) (Pogg. Ann. B. 17.) |

1829. May 8. A single stone (36 lbs) fell near Forsyth, Georgia (U. S. A.) Light gray ground mass with rust brown spots. Contains metallic iron in small particles also magnetic pyrites. The crust is thick and dull black. Sp. gr. 350.

Analyzed by Shepard.

A = Unmagnetic part.

B = Magnetic part.

|     | SiO <sup>3</sup> | FeO   | MgO       | CaO  | Al <sup>2</sup> O <sup>3</sup> |
|-----|------------------|-------|-----------|------|--------------------------------|
| A = | 50.00            | 33.33 | 9.30      | 5.30 | 1.80                           |
|     | Fe               | Ni    | Cr + Loss |      |                                |
| B = | 89.00            | 9.60  | 1.40.     |      | (Am. J. sc. 25 B. 6.)          |

1829. Aug. 14. A stone of some size fell at Deal, in New Jersey (U. S. A.). The fall was accompanied with a bright flame and twelve successive explosions. The ground mass is light gray, and contains metallic iron and has a dull black crust.

1829. Sep. 9. A stone fell at Krasno-Ugol, Russia. Dark greenish gray ground mass, much granulated. Contains metallic iron in fine particles also magnetic pyrites. Has a black crust which is smooth and somewhat glassy. (D. M. p. 45.)

1830. Feb. 15. A stone (2½ lbs) fell at Lauton near Oxford, England. No particular description or analysis has been given as I can find. (Pogg. Ann. B. 54.)

1831. July 18. A single stone (40 lbs) fell at



Vouillé, France. A light gray mixed with a bluish gray ground mass, with a few spots. Contains metallic iron and magnetic pyrites. Crust has a slight lustre.

Sp. gr. 3.55.

(D. M. p. 60.)

1831. Sep. 9. A single stone (7 lbs) fell near Wesseley, Moravia. Dark bluish ground mass with rust brown spots and dark streaks, very granulous, contains much metallic iron, and very fine particles of magnetic pyrites. The crust is dull black and somewhat scaly.

(D. M. p. 66.)

1833. Nov. A shower of meteorites fell at Kandahar, India. Many houses were broken in and some persons killed.

(Compt. Rend. B. 3.)

1833. July 16. During a hail storm many small cornered stones fell at Nachratschinski, Russia.

(Pogg. Ann. B. 34.)

1833. Nov. 25. Eight stones fell at Blansko, Moravia. A dark gray ground mass with rust brown spots, somewhat granulous. Much metallic iron and fine particles of magnetic pyrites. Crust black with a slight lustre. Sp. gr. 3.70.

Analyzed by Berzelius.

I. The magnetic part was 17.15 procent of the whole and gave

| Fe     | Ni    | Co    | Zn + Cu | S     | P      |
|--------|-------|-------|---------|-------|--------|
| 93.816 | 5.053 | 0.347 | 0.460   | 0.324 | Trace. |

II. The ground mass gave as

silicate decomposed by acid 51.5 = A.

„ undecomposed „ „ 48.5 = B.



|     | SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | MgO    | CaO                                | FeO    | MnO   |
|-----|------------------|--------------------------------|--------|------------------------------------|--------|-------|
| A = | 33.084           | 0.329                          | 36.143 | —                                  | 26.935 | 0.465 |
| B = | 57.145           | 5.590                          | 21.843 | 3.106                              | 8.592  | 0.724 |
|     | NiO              | NaO                            | KO     | Cr <sup>2</sup> O <sup>3</sup> FeO |        |       |
|     | 0.465            | 0.857                          | 0.429  | —                                  |        |       |
|     | 0.021            | 0.931                          | 0.010  | 1.533.                             |        |       |

(Pogg. Ann. Bd. 33.)

1833. Dec. 28. A stone meteorite (30 lbs) fell near Akaninak Volhynia, Russia. (Phil. Mag. 4 S. Vol. 8. p. 459.)

1834. June 12. A stone (8 lbs) fell at Charwallas India. Was brought to England a few years ago. It is dark colored, very compact and resembles mostly our trap rock. It contains 15.07 percent nickeliferous iron, and also traces of sulphur. It is much decomposed by the action of the weather.

(Am. J. sc. 2 S. B. 11.)

1834.? Nov. 13. A shower of meteorites fell at Raffaten on the borders of Hungary and Wallacia.

(Phil. Mag. 4 S. B. 8. p. 459.)

1834. Dec. 15—16. During a hail storm a large number of stones fell at Marsala, west coast of Sicily. They were very compact, quite brittle and hard, with a yellowish color.

(Pogg. Ann. B. 4. E. p. 34.)

1835. Jan. 18. A stone meteorites fell near Löbau, Oberlausitz. It exploded into small pieces upon reaching the earth. It is extremely porous, of a brick red color, and contains much metallic iron.

(J. pr. Chem. B. 5.)

1835. Aug. 4. A stone (2 lbs) fell near Cirencester, England.

(Phil. Mag. 4 S. Bd. 8. p. 459.)



1835. Nov. 13. Two stone fell as simond, de l' Ain, France. The ground mass is black and homogeneous, has a slight lustre, is brittle, and has much the appearance of Obsidian. Sp. pr. 1.34.

(L'Inst. No. 141.) (Pogg. Ann. B. 36.)

1836. Nov. 11. At Macao, Brazile, an immense shower fell on a space twenty miles in diameter, dark gray ground mass with rust spots, very compact, much metallic iron and some magnetic pyrites, crust dull black and in places glassy. Sp. gr. 3.72.

(Compt. Rend. B. 5.) (D. M. p. 81.)

(Ostriche Bl. f Literatur 1847.)

1836. — A stone is reported to have fallen near or in Platten See, Hungary.

1837. Jan. 15. A stone fell at Mikolowa, in Szalader Comitatus. It was found while yet red hot.

(Pogg. Ann. 4. E. p. 356.)

1837. May 5. A bright meteor appeared at East Bridgewater, Mss. (U. S. A.) and nine stones fell from the same. The inner mass is gray and porous, the crust is glassy, and they appear most like some lavas or scoriae. Sp. gr. 2.16. (Am. J. sc. Vol. 32.)

1837. July 24. A single stone (13 lbs) fell near Gross-Divina, Hungary. The ground mass between a light and a dark gray, with many rust spots. Very granulated in structure. Contains metallic iron and magnetic pyrites, crust black, partly smooth and partly rough. Sp. gr. 3.55. (D. M. p. 79.)

1837. Aug. — At stone (3 lbs) fell at Esnaude, Charente France.

(Pogg. Ann. 4. E. p. 357.)



1838. Apr. 18. A meteoric stone (4 lbs) fell near Akburpoor, India. (Phil. Mag. 4. S. B. 8. p. 460.)

1838. June 6. There fragments of a stone meteorite were found near Chandakapore, India.

(Phil. Mag. 4. S. B. 8. p. 460.)

1838. Oct. 13. A remarkable fall of meteorites occurred at Cold, Bokkewelde, Cape of good Hope. A large bright meteor passed in a S. E. direction. Its powerful explosion resembled a heavy discharge of artillery and was distinctly heard at a distance 40 miles. The number of stonels that fell was very great and some of then were of great weight. The mass is nearly homogeneous, and nearly black. No metallic iron is to be seen. It is not very coherent and therefore easily broken and pulverised. It has a dull black crust but differs but little from the ground mass only that it is harder and more compact. Sp. gr. 2.69.

Analyzed at first by Faraday.

|     |      |                  |       |      |                                |      |      |                                |       |
|-----|------|------------------|-------|------|--------------------------------|------|------|--------------------------------|-------|
| HO  | S    | SiO <sup>3</sup> | FeO   | MgO  | Al <sup>2</sup> O <sup>3</sup> | CaO  | NiO  | Cr <sup>2</sup> O <sup>3</sup> | NaO   |
| 6.5 | 4.24 | 28.9             | 33.22 | 19.2 | 5.22                           | 1.64 | 0.82 | 0.7                            | Trace |

For more on this stone see page 35.

(Phil. Mag. 3. S. B. 14.)

1839. Feb. 13. A large meteoric stone fell at Little Piney Point, Missouri (U. S. A.). It exploded and over 50 lbs of fragments were obtained. A dark gray ground mass with bright points of metallic iron. The crust is dark brown, thin, and has been partly melted. Sp. gr. 3.5.

Analyzed by Shepard.



| SiO <sub>2</sub> | MgO   | FeO   | Al <sub>2</sub> O <sub>3</sub> | NaO | Fe    | CaO  | Cr | Ni |
|------------------|-------|-------|--------------------------------|-----|-------|------|----|----|
| 31.37            | 25.88 | 17.25 | 0.49                           | ?   | 16.00 | 4.28 | ?  | ?  |
| S + Loss         |       |       |                                |     |       |      |    |    |
| 4.73             |       |       |                                |     |       |      |    |    |

(Am. J. sc. B. 37. 39. and 2. S. B. 6.)

? 1839. Nov. 23. A stone fell near Naples, Italy.  
(Pogg. Ann. 4. E. p. 360.)

1840. May 9. A stone fell at Krighis, Steppes, Tartary.  
(D. M. p. 143.)

1840. Juni 12. A stone fell near Uden, North-brabant.  
(Pogg. Ann. B. 59.)

1840. July 17. Three stones (one 11 lbs) fell in the province Cassal, near Ceresetto, Piedmont.  
(Compt. Rend. Bd. 11.)

1841. Mar. 22. A single stone (2½ lbs) fell near Grünberg, Silesia. A bluish gray ground mass with some yellowish white particles, finely granulated. Contains much metallic iron and but little magnetic pyrites has a thin black crust. Sp. gr. 3.71. (Pogg. Ann. Bd. 53.)

1841. June 12. A single stone (75 lbs) fell at chateau Renard, France. Light ash gray ground mass with lighter colored spots and many black particles, much metallic iron and fine particles of magnetic pyrites, has a dull black crust. Sp. gr. 3.54.

Analysis by Dufrénoy.

It contained 9—10 pr. cnt. Nickeliferous iron. The unmagnetic pars gave nearly equal parts of A. decomposed silicate and B. undecomposed silicate.



|     | SiO <sup>3</sup> | MgO   | FeO   | Al <sup>2</sup> O <sup>3</sup> | CaO  | NaO  | KO   |
|-----|------------------|-------|-------|--------------------------------|------|------|------|
| A = | 35.69            | 19.46 | 44.85 | —                              | —    | —    | —    |
| B = | 51.77            | 18.33 | 17.51 | 10.22                          | 0.47 | 2.30 | 0.68 |

(Compt. Rend. vol. 12 and 13.)

1841. Aug. 10. A remarkable shower of small stones occurred at Iwan, Hungary. They are not to be compared with any other known meteorites, the most of them not larger than peas. They are compared to the „Bohnertz“ in the Hartz. The color is dark brown, when pulverised light-brown, not magnetic. It is a question whether they should be called meteorites proper. They were qualitatively examined, and found to contain:

SiO<sup>3</sup>. AlO<sup>3</sup>. CaO. Fe<sup>2</sup>O<sup>3</sup>. PO<sup>5</sup>. SO<sup>3</sup>CO<sup>2</sup>.

(Pogg. Ann. 54. 279.)

1841. Nov. 5. A stone (11 lbs) fell near Bourbon-Vendé, France. (D. M. p. 144.)

1842. Apr. 26. Two or three stones (11 lbs) fell near Milena in Croatia, Austria. Light gray ground mass with rust brown spots and some dark colored grains, contains metallic iron and fine particles of magnetic pyrites, crust black and has a slight lustre. Sp. gr. 3.54. (Pogg. Ann. B. 56.)

1842. July 4. A stone (7 lbs) fell near Logrono, Spain. Phil. Mag. 4. S. 8. 460.

1842. Aug. 5. A large stone fell near Harrogate, England. It has the appearance of Basalt and had many silverwhite particles, metallic iron?

(L'Inst. No. 457.)



At this place should be given three stone meteorites whose time of falling is previous to this date but not well known.

1st A stone fell in government Poltava, Russia. Dark gray ground mass with many grains of a greenish color, contains metallic iron and magnetic pyrites. Crust dull black and very porous. Sp. gr. 3.33.

(D. M. p. 44.)

2d A stone fell in government Kursk, Russia. The description is the same as above only that the grains are nearly black instead of greenish. Sp. gr. 3.55.

(D. M. p. 70)

3d A meteoric stone comes from government Simbirsk, Russia. Dark gray ground mass, very compact and coherent in structure. The particles of metallic iron are very small, mostly microscopic. The crust is thin, dull black and presents a scurfy appearance on its surface. Sp. gr. 3.53. (D. M. p. 46.)

1843 Mar. 25. A stone (13 lbs) fell near Bishopville, S. Carolina (U. S. A.) The ground mass presents a mixture of several colors which make together a dark bluish gray; resembles a piece of marble. Contains no metallic iron. The crust is dark colored and glassy on its surface. Sp. gr. 3.02.

Analyzed by S. v. Waltershausen.

| SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> | MgO   | CaO  | HO   | sum     |
|------------------|--------------------------------|--------------------------------|-------|------|------|---------|
| 67.14            | 1.48                           | 1.70                           | 27.12 | 1.82 | 0.67 | = 99.93 |

(Ann. Ch. Pharm. 79. 369. — Am. J. sc. 2. S. vol. 6.)

1843 June 2. A stone (14 lbs) fell near Utrecht, Holland. It sunk three feet in the ground and its ex-



plosion was heard at a distance of 12 miles. The ground mass is light gray and contains metallic iron, and magnetic pyrites, is very granulous in structure. Sp. gr. 3.61.

Analysis by Baumhauer.

Magnetic part = 14.24 = A.

Silicat decomposed in Acid 42.98 = B.

„ Undecomposed „ „ 42.58 = C.

Chromic iron 20 = D.

A = 14.24 = 9.14 Nickeliferous Iron = A' and 5.1

magnetic pyrites = A''

A' = Fe Ni + Ca FeP Cu + Zn A'' = Fe S

85.89 13.59 0.25 0.27 62.67 37.23

B = SiO<sup>3</sup> Al<sup>2</sup>O<sup>3</sup> FeO MgO CaO NaO Ko MnO + Ni

36.66 0.14 23.47 38.96 0.41 0.27 0.09 —

C = 56.43 5.03 11.50 18.25 3.06 3.03 0.26 1.45

CuO + SnO<sup>2</sup>

—

0.62 (Pogg. Ann. 66. 465.)

1843 July 26. A large stone ten inches in diameter fell near Manegon, Khandrich, India. The ground mass is nearly yellow and easily reduced to a powder. Contains many green particles of Olivine. The crust is black and has some lustre. Sp. gr. 4 to 4.5. — ?

(Rep of Brit. Assoc. f. 1850.)

1843 Sept. 16. A stone (5½ lbs) fell near Klein-Wenden, Nordhausen, Germany. The ground mass is grayish white and finely granulated, has some dark colored grains. Contains metallic iron. Sp. gr. 3.70.

Analyzed by Rammelsberg.

The magnetic part = 18.37 per cent gave



| Fe     | Ni + Co | Sn    | Cu    | S     | P     | sum    |
|--------|---------|-------|-------|-------|-------|--------|
| 88.852 | 10.319  | 0.348 | 0.212 | 0.122 | 0.107 | = 100. |

The ground mass gave:

Silicate decomposed in acid 48.255 = A.

„ undecomposed „ 50.591 = B.

Chromic Iron 1.154 = C.

| A = SiO <sup>3</sup> | MgO    | CaO   | MnO   | CuO   | Te     | Ni    | S     |
|----------------------|--------|-------|-------|-------|--------|-------|-------|
| 31.206               | 37.330 | 1.674 | 0.148 | 0.159 | 23.665 | 0.961 | 5.264 |

| B = SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | CaO   | FeO    | MgO    | NiO   | CuO   | NaO   | KO    |
|----------------------|--------------------------------|-------|--------|--------|-------|-------|-------|-------|
| 51.009               | 9.077                          | 4.795 | 11.063 | 22.072 | 0.203 | 0.152 | 0.708 | 0.921 |

(Pogg. Ann. 62. 449.)

1844 Apr. 29. A stone fell at Killeter, Tyrone, Ireland. (Phil. Mag. 4. S. 8. 460.)

1844 Oct. 2. A stone is reported to have fallen at St. Andrews, Cuba, but it is not beyond doubt.

(Phil. Mag. 4. S. 8. 460.)

1844 Oct 21. A stone fell at Favers, Switzerland.

(L'Inst. No. 570.)

1846 May 8. Nine stones differing in weight from a few ounces to six pounds, fell near Monte Miloni in Italy. The ground mass is light gray with some streaks; It is fine granulated and partly crystalline. It contains metallic iron and fine particles of magnetic pyrites. It has a black crust. (L'Inst. No. 666.)

1846 Nov. 11. A stone fell at Lowell, Mss. (U. S. A.) The meteor before the fall was bright and appeared as large as the sun. The mass was 4 feet in diameter and weighed 442 lbs. (L'Inst. No. 679.)

1846 Oct. — A single small stone fell at Con-



cord New Hampshire. (U. S. A.) The ground mass is nearly white and is exceedingly porous.

Analyzed by Silliman.

| SiO <sup>3</sup> | MgO    | NaO   | Loss   |                            |
|------------------|--------|-------|--------|----------------------------|
| 84.973           | 12.076 | 2.218 | 0.233. | (Am. J. sc. 2. S. 6. 353.) |

1846 Dec. 25. A stone (17 lbs.) fell near Mindelthal, Germany. Ground mass light gray, finely granulated, slightly coherent, contains metallic iron, has a black porous crust. Sp. gr. 3.75. (Pogg. Ann 70. 335.)

1846 Summer. A small stone (7 Oz.) fell near Richland S. Carolina (U. S. A.) A young negro witnessed the fall, and immediately ran to the spot and after digging 18 inches he found it and ran to his mistress declaring that he had a „lump of solid thunder.“ It has a homogeneous ground mass with brick-red color, mixed with some light colored grains. It has a glassy crust and is closely adherent to the mass. Sp. gr. 2.32.

Analysis by Schepard.

| SiO <sup>3</sup>            | Al <sup>2</sup> O <sup>3</sup> | FeO   | MgO   | CaO   | Sum      |
|-----------------------------|--------------------------------|-------|-------|-------|----------|
| 80.420                      | 15.680                         | 2.513 | 0.700 | 0.500 | = 99.813 |
| (Am. J. sc. 2. S. 10. 127.) |                                |       |       |       |          |

1847 Feb. 25. A large number of stones varying in weight from one to fifty pounds fell near Hartford, Linn. Co Iowa (U. S. A.) The ground mass is quite homogeneous of a pearlgray color mixed with some rust brown spots, contains metallic iron. They have a thin black crust. Sp. gr. 3.58.

Analyzed by Shepard.



|                  |       |       |          |         |               |
|------------------|-------|-------|----------|---------|---------------|
| SiO <sup>3</sup> | FeO   | MgO   | NaO + KO | Sum     | or. Howardite |
| 63.06            | 24.60 | 11.74 | 0.31     | = 99.71 | 83.00         |

Nickeliferous Iron, Magnetic pyrites. Olivinoid.

10.44

5.00

Trace.

(Am. J. sc. 2. S. 6. 288.)

1847 Dec. 8. A meteorite fell near Forest Hill, Arkansas (U. S. A.) It sunk several inches in the earth and was very warm when found. It was surrounded with a black crust. (Am. J. sc. 2. S. vol. 5. 293.)

1848 Feb. 15. A stone (4 lbs) fell near Dharwar, India. The ground mass is grayish white, and much resembles sand stone, contains metallic iron and has a thin glassy crust. Sp. gr. 3.51.

Only a partial analysis was made.

|                 |    |       |      |                               |
|-----------------|----|-------|------|-------------------------------|
| Earthy silicate | S  | Fe    | Ni   |                               |
| 58.3            | 25 | 22.18 | 6.76 | (Edin. New. Phil. J. 47. 53.) |

1848 May 20. A small stone (1½ oz.) fell near Castine, Maine (U. S. A.). It is characterized by its light color and a pearly glance, and has a dull black crust. Contains metallic iron. Sp. gr. 3.46.

Analyzed by Shepard.

Magnetic part 11.22 per cent of the mass gave

Fe

Ni

85.3

14.7.

The ground mass was Howardite. A trisilicate of magnesia and protoxyd of iron. (Am. J. sc. 2. S. 6. 252.)

1849 Nov. 13. A large meteorite or probably a shower of stones fell at Tripolis in Africa.

(Pogg. Ann. 4 E. p. 382.)

1849 Oct. 31. A stone (19½ lbs) fell near Char-



lottetown, Cabarras Co. N. Carolina (U. S. A.) It has a bluish gray ground mass and resembles trap rock, is compact and coherent in structure, and has a dull black crust. Sp. gr. 3.63.

Analyzed by Shepard.

$$\text{SiO}_3 \quad \text{FeO} \quad \text{MgO} \quad \text{Al}_2\text{O}_3 \quad \text{CuO} + \text{Na}_2\text{O} + \text{K}_2\text{O}$$

56.168 18.108 10.406 1.797 3.394

Nickeliferous Iron  $\text{FeS}$ 

6.320

3.807

(Am. J. sc. 2. S. 9. 143 and 10. 127.)

1849 Mar. 19. A stone meteorite fell near Poonah,  
India. (Phil. Mag. 4. S. 8. 460.)

1850 Jan. 25. A shower of stones fell at Tripoli.

(Edin. New. Phil. J. 50. 181.)

1850 Nov. 30. A large stone 3 feet in diameter fell  
near Bissempore, India. (Rep. of the Brit. Ass. f. 1851. p.41.)

1851 April — A stone (2½ lbs) fell near Guterslof, Westphalia, Germany. It has a mixed gray ground mass, contains metallic iron, and has a dull black crust.

(Pogg. Ann. 83. 465.)

1852 Sep. 24. Several stones, one weighing 18 lbs  
fell near Mezo-Madaras, Transylvania. This stone is in  
every way similar to the one from Seres, Macedonia,  
Turkey, which fell, June 1818. Sp. gr. 3.50.

Analyzed by Wöhler and Atkinson.

SiO<sub>3</sub> MgO Fe Ni Co Graphite FeO MnO Al<sub>2</sub>O<sub>3</sub>

43.64 23.83 18.10 1.45 0.05 0.25 4.61 0.28 3.15

CaO NaO KO

1.80 2.34 0.50



Treated with H. Cl. it gave

undecomposed silicate 30.48 = A.

decomposed „ 50.92 = B.

Nickeliferous iron 19.60 = D.

|     |                  |       |       |      |                                |      |
|-----|------------------|-------|-------|------|--------------------------------|------|
| A = | SiO <sup>3</sup> | MgO   | FeO   | CaO  | Al <sup>2</sup> O <sup>3</sup> | Na   |
|     | 60.70            | 15.29 | 15.25 | 3.05 | 1.85                           | 1.91 |

(Wien. Acad. Ber. 17. 284.)

1852. Oct. 13. A stone (12 lbs) fell near Borkut, Hungary. It has a light ash gray ground mass in which are many shining particles of metallic iron. The crust is thin and has a dull black color.

Analyzed by Nurisany.

Magnetic part = 18.26 procent gave

|       |       |         |      |      |       |
|-------|-------|---------|------|------|-------|
| Fe    | Ni    | Cu + Sn | S    | P    | sum   |
| 85.14 | 10.06 | 0.40    | 4.19 | 0.18 | 99.97 |

The ground mass gave decomposed silicate 51.58 = A.  
undecomposed „ 48.46 = B.

|                  |                                |       |      |      |       |      |      |      |
|------------------|--------------------------------|-------|------|------|-------|------|------|------|
| SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | FeO   | Ni   | CaO  | MgO   | KO   | NaO  | S    |
| A = 30.77        | 2.62                           | 31.33 | 1.51 | 1.02 | 30.53 | 0.43 | 1.08 | 0.30 |
| B = 56.37        | 4.13                           | 11.83 | —    | 3.84 | 17.39 | 1.12 | 3.66 | —    |

(Wien. Acad. Ber. 20. 387.)

1853. Feb. 10. A large stone fell near Girgenti, Sicily. Sp. gr. 3.76. (Phil. Mag. 4. S. B. 8. p. 460.)

1854. Sept. 5. A stone (4 lbs) fell near Fehrbellin, Prussia. The ground mass is of a light gray color and has a finely granulated structure. Contains small particles of metallic iron. It has a dull black crust which is rather thick.

(Monatsb. der K. Acad. d. Wiss. zu Berlin Oct. 1854.)

1854. Dec. 27. A small stone (1½ lbs) fell in



Schie, Norway. It has a light gray ground mass, and through it diffused many particles of metallic iron, has a black glassy crust. Sp. gr. 3.54.

Analyzed by Ditten.

The magnetic part gave.

|  | Fe   | Ni    | FeS   |
|--|------|-------|-------|
|  | 84.3 | 14.42 | 0.49. |

The ground mass gave as decomposed silicate = A.

„ „ undecomposed „ = B.

|     | SiO <sup>3</sup> | MgO   | CaO  | FeO   | Al <sup>2</sup> O <sup>3</sup> | Fe <sup>2</sup> O <sup>3</sup> |
|-----|------------------|-------|------|-------|--------------------------------|--------------------------------|
| A = | 33.80            | 31.68 | 3.08 | 27.44 | —                              | —                              |
| B = | 57.10            | 19.46 | 1.47 | —     | 5.62                           | 14.72.                         |

(Das chem. Laboratorium der Univ. Christiania 1854. 82.)

(J. pr. Chem. 64. 121.)

1855. May 11. A stone (12 lbs) fell in the northern part of the island. Oesel. It was broken in pieces by the explosion. It has a homogeneous ground mass of a bluish gray color, resembling basalt, is very compact and coherent in structure. It has a thin black crust, contains metallic iron analyzed by Gobel.

Magnetic part 13.07 pr., ct. = A.

Ground mass decomposed by HCl 46.86 = B.

„ „ Undecomposed 40.08 = C.

|      |   |       |                                     |
|------|---|-------|-------------------------------------|
| A =  | { | 12.75 | Nickeliferous iron.                 |
|      |   | 0.25  | FeS.                                |
|      |   | 0.06  | FeO. Cr <sup>2</sup> O <sup>3</sup> |
|      |   | 0.01  | FeP.                                |
| B. = | { | 41.13 | olivine                             |
|      |   | 5.59  | FeS                                 |
|      |   | 0.14  | FeO Cr <sup>2</sup> O <sup>3</sup>  |



$$C = \begin{cases} 41.13 \text{ Olivine.} \\ 5.59 \text{ FeS.} \\ 0.14 \text{ FeO. Cr}^2\text{O}^3. \end{cases}$$

(Ann. Chem. Phar. 98. 387.) (Pogg. Ann. 99. 642.)

1855. May 13. A remarkable fall of stone meteorites occurred near Bremervörde in Hanover. Five stones of different sizes were found and weighed together nearly 14 lbs. The ground mass has a granulated structure and a grayish color, showing a mixture of several different minerals. There are to be seen some small green particles of olivine, some magnetic pyrites and a little Graphit. It contains quite a large quantity of metallic iron. The crust is rough on its surface, of a brownish black color and quite thin. Sp. gr. 3.54.

Analyzed by Wöhler.

| SiO <sup>3</sup>                                                       | MgO   | FeO  | Al <sup>2</sup> O <sup>3</sup> | Fe    | Ni    | NaO  | KO   |
|------------------------------------------------------------------------|-------|------|--------------------------------|-------|-------|------|------|
| 45.40                                                                  | 22.40 | 4.36 | 2.34                           | 21.61 | 1.89  | 1.18 | 0.37 |
| Cr <sup>2</sup> O <sup>3</sup> FeO   Graphit   CoO + P + S + CaO + MnO |       |      |                                |       |       |      |      |
| 0.31                                                                   |       | 0.14 |                                |       | Trace |      |      |

(Nachrichten von d. Univ. u. d. K. Gesellsch. d. Wiss. zu Göttingen 1856. No. 8. 145.)

(Jahresb. Liebig u. Kopp. 1856. 914.)

1855. Aug. 5. A stone (3 lbs) fell near Petersberg. Tennessee. Several reports were heard at the time of the fall. It sunk 18 inches in the ground and when first taken out it was too warm to be held in the hands. The inner mass has an ash gray color, varied by patches of white, yellowish and dark colored minerals. It contains metallic iron and is invested in a very thin black and shining crust. Sp. gr. 3.20.

Analyzed by J. L. Smith.



| SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | FeO   | CaO  | MgO  | Mn   | Fe   | Ni    |
|------------------|--------------------------------|-------|------|------|------|------|-------|
| 49.21            | 11.05                          | 20.41 | 9.01 | 8.13 | 0.04 | 0.50 | Trace |

P S Na

Trace 0.06 0.83.

(Am. J. sc. 2. S. B. 24. p. 134.)

1856. Sep. 17. A large meteorite was seen to fall into the sea near Civitavecchia, Italy. It was observed in clear daylight and was followed by a streak of fire.

(Pogg. Ann. 99. 644.)

1857. Apr. 15. A meteoric stone weighing (7 lbs) fell near Kaba in Hungary. It fell in the middle of the road about 10 oclock in the evening. It sunk its whole size into the hard road so that its upper surface and the road were on the same level. The heavy report of its explosion was heard at the time of the fall but the stone was first seen the following morning. The ground mass is dark gray and through this mass were scattered many black concretions, some as large as peas so that the whole mass had somewhat of a porphyritic appearance. One part of the stone contains metallic iron in small round particles and another part seems to contain no perceptible amount. The crust is brownish black on one side and pure black on the other, and on both sides the color is dull.

Analyzed by Wöhler.

| Carbon                         | Fe   | Ni        | Cu   | Cr <sup>2</sup> O <sup>3</sup> | FeO    | FeS  | FeO   | MgO   |
|--------------------------------|------|-----------|------|--------------------------------|--------|------|-------|-------|
| 0.58                           | 2.88 | 1.37      | 0.01 | 0.89                           |        | 3.55 | 26.20 | 22.39 |
| Al <sup>2</sup> O <sup>3</sup> | CaO  | KO + NaO? | MnO  | SiO <sup>3</sup>               | Co + P |      |       |       |
| 5.38                           | 0.66 | 0.30      | 0.05 | 34.24                          | Trace  |      |       |       |

unknown substance

not determined.



This „Unknown substance“ is an organic substance of a resinous nature such as described in the analysis of the meteorite from Cape of good Hope which fell. Oct. 13. 1838. For more particulars see.

(Wien. Acad. Ber. B. 33. p. 205.)

1857. Oct. 10. A large stone weighing (29 lbs) fell near Ohaba in Blasendorf District. Hungary. The ground mass is light gray and contains many small spherical concretions. Some small particles of olivine are to be seen. It contains many large and many small globules of metallic iron; and many fine particles of magnetic pyrites. It is surrounded by a dull black crust, which in some places is smooth and in others rough and blistered. Sp. gr. 3.11.

Analysed by Bukeisen.

| Fe    | Ni   | FeS   | SiO <sup>3</sup> | MgO   | FeO                               | MnO  | Al <sup>2</sup> O <sup>2</sup> |
|-------|------|-------|------------------|-------|-----------------------------------|------|--------------------------------|
| 21.40 | 1.80 | 13.14 | 36.60            | 23.45 | 1.75                              | 0.15 | 0.28                           |
|       |      |       | KO + NaO         |       | FeOCr <sup>2</sup> O <sup>3</sup> |      |                                |
|       |      |       | 0.38             |       | 0.56                              |      |                                |

The 18.27 per cent decomposed silicat gave SiO<sup>3</sup> 43 MgO 57.

The 44.83 per cent undecomposed silicat would contain:

| SiO <sup>3</sup> | Al <sup>2</sup> O <sup>3</sup> | FeO  | MnO  | MgO   | NaO  | KO   |
|------------------|--------------------------------|------|------|-------|------|------|
| 64.10            | 0.62                           | 3.90 | 0.33 | 29.08 | 1.09 | 1.09 |

(Wien. Acad. Ber. B. 31. p. 79.)

1858. May 19. A small stone fell near, Kakowa in Hungary. For analysis and description See page 22 also.

(Wien. Acad. Ber. 34. 11.)

1858. Probably near the first of Aug. a stone meteorite fell near Costa-Rica Central America. This is mentioned no where before this as I find. Prof. Wöhler has



a fine specimen of this meteorite which weighs nearly a pound, and seems to be about one half of a complete stone. It was sent to him by a friend residing at that place. The letter accompanying it was dated the 19th of Aug. It does not give the date of the fall but it was near that time. It was seen first as a bright meteor passing rapidly through the air. It exploded violently and caused much commotion among the astonished beholders. Several pieces of considerable size were found. It has a mixed gray ground mass, and seems to contain a large amount of Graphite distributed through the mass in broad thin plates. It is quite compact in structure and contains bright globules of metallic iron. It is covered by a thin black crust which does not separate from the inner mass. Its specific gravity and chemical composition are not determined.

1858. Dec. 9. A large stone meteorite (120 lbs) fell at Montrejean near Ausson in France. For description and analyses see page 45. also. (Compt. Rend. 48. 193.)

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## PART II.

### METALLIC METEORITES.

This class of meteorites consists mostly of metallic iron alloyed with nickel, cobalt and phosphorus. Only very few of them have been seen to fall, but from their peculiar characteristics they are easily recognized when found, although their fall may have occurred ages



previous. At first I shall mention a couple of such meteorites which occupy a position between stone and metallic meteorites, afterwards I shall give them in the order in which they have been found; and at last those whose time of discovery is unknown.

1856 July 21. Dr. Mühlenpfordt found a meteoric mass (33 lbs) near Hainholtz, Hannover. Prof. Wöhler examined it and found it to be a meteorite. One half of it is an olivine silicate and the other half is metallic iron. It was surrounded with a thick crust of iron oxyd. Sp. gr. 4.61. (Pogg. Ann. 100. 342.)

#### KRASNOJARSK. Siberia.

Found in 1749. described by Pallas in 1776. It originally weighed 1680 lbs. is now at St. Petersburg. The metallic part is of a cellular structure and the cells are filled with chrysolite. The iron constitutes about one half the whole mass. It is surrounded with a crust of oxyds. Sp. gr. 7.16 — 7.84 of the chrysolite 3.34.

Analysis by Berzelius.

Metallic portion

| Insoluble | Fe     | Ni     | Co    | Mg    | Mn    | Sn + Cu | C     |
|-----------|--------|--------|-------|-------|-------|---------|-------|
| 0.480     | 88.042 | 10.732 | 0.455 | 0.050 | 0.132 | 0.066   | 0.043 |

| The chrysolite part gave | SiO <sub>3</sub> | MgO   | FeO   | MnO  | SnO  |
|--------------------------|------------------|-------|-------|------|------|
|                          | 40.86            | 47.35 | 11.72 | 0.93 | 0.17 |

(Gilb. Ann. B. 13 und 57.) (Pogg. Ann. 33.)

#### ATACAMA. BOLIVIA. S. America.

Described by Dr. Redhead in 1827. The original mass is estimated to have weighed 300 lbs. The proportion of iron and chrysolite in this specimen is ab-



out equal volumens of each. The chrysolite is contained in angular cavities in the iron. Sp. gr. of the metal. = 7.44 — 7.66 of the chrysolite 3.33.

Analyses of metallic portion. Of chrysolite

|        | Fe    | Ni   | Co   | Insol. |        | SiO <sup>3</sup> | MgO   | FeO   | Al <sup>2</sup> O <sup>3</sup> |
|--------|-------|------|------|--------|--------|------------------|-------|-------|--------------------------------|
| Rivero | 90.40 | 8.60 | —    | 0.30   | Kobel. | 40.79            | 47.05 | 12.10 | 0.02                           |
| Allan  | 93.40 | 6.62 | 0.54 | —      |        |                  |       |       |                                |

More recently analyzed by Frapolli.

|  | Fe    | Ni    | Co   | Mg   | Co   | Na   | K    | P    |
|--|-------|-------|------|------|------|------|------|------|
|  | 88.01 | 10.25 | 0.70 | 0.22 | 0.13 | 0.21 | 0.15 | 0.35 |

(Jahrb. f. Min. 1857.) (Edinb. Trans. 11. 223.) (Pogg. B. 14. and 45.)

### SAXONY.

Found near Steinbach, Saxony, described by Lehman in 1751. Partsch has shown that several metallic meteorites said to be from Norway and also the meteorite called „Nauhof“ are all from this same locality.

They consist of a vesicular, metallic mass, the cells of which are filled with Chrysolite. It exhibits Widmannstettian figures. Sp. gr. 7.50.

(D. M. 91) (Gilb. Ann. 50. 259.)

1620 April 17. An iron mass (7 lbs.) fell near Jalindher, Persia.

(Phil. Mg. 4. S. vol. 8. p. 461.)

### SENEGAL. Africa.

Made known by Compagnon in 1717. Large quantities of metallic iron are scattered in these regions. These specimens are compact metallic masses. They have a crystalline structure. Sp. gr. 7.72.

Analysis by Howard. Fe 95 Ni 5.

(Phil. Trans. 1802.) (D. M. 130.)



**HRASCHINA.** near Agram, Croatia.

Seen to fall May 26. 1751. This for nearly 100 years was the only metallic mass known positively to have fallen. It was observed at first as a bright fire ball in rapid motion through the air. It burst with a great explosion into two pieces, the larger 71 lbs the smaller 16 lbs. They have a brownish black crust, easily separated from the inner mass. The Widmanstettian figures were first discovered in this mass. Sp. gr. 7.72 — 7.82.

Klaproths Analysis Fe 96.6 Ni 3.5. Wehrler found Fe 89.784 Ni 8.886 No 0.667.

(D. M. S. 103.) (Gilb Ann. B. 13. B. 18.)

1780. An iron mass is said to have fallen at Lahore, India.

(Phil. Mag. 4. S. vol 8. p. 461.)

**TUCUMAN.** Argentine republic. S. A.

Described in 1783, was found sometime previous Weight: 30.000 lbs. It was covered with a thick crust of metallic oxyds. It is crystalline in structure and shows the usual figures, the metal is very malleable. Sp. gr. 7.54 — 7.60.

Analysis by Howard. Fe 90. Ni 10.

(D. M. S. 128.) (Phil. Trans. 1788 and 1802.)

**ZIQUIPILCO.** North of Toluca, Mexico.

Mentioned in 1784 in the „Gazeta de Mexico“ in which it is stated that many small pieces of native iron are found at this locality. It is very compact in structure. It shows Widmannstättian figures. Sp. gr. 7, 72. Analysis by Berthier Fe 91.38. Ni 8.62.

This is more recently analysed by W. J. Taylor and



found to contain. Fe 90.72. Ni 8.49. Co 0.44. Schreibersit, Chromic Iron 0.38. Si 0.25. P. 0.18.

(Gazeta de Mexico 1784—85. vol. 1. p. 146.) (Klaproths Beiträge B. 4. p. 101.) (Am. J. sc. 2. S. vol. 22. p. 379.)

More recently many pieces of this meteoric iron have been obtained. Mr. G. A. Stein has brought to Europe four specimens, one of  $5\frac{1}{2}$  lbs. one of 13 lbs one of  $19\frac{1}{2}$  lbs and one of 220 lbs. They were found scattered over a small area in the Toluca valley and doubtless all belong to one and the same fall. The 13 lbs mass was analyzed by Uricoechea. The 220 and the  $19\frac{1}{2}$  lbs. masses were analyzed by Pugh and the  $5\frac{1}{2}$  lbs piece was analyzed by Nason.

|                       | Fe    | Ni   | Co    | P    | Cu + Sn | S     |
|-----------------------|-------|------|-------|------|---------|-------|
| 13 lbs mass           | 90.40 | 5.02 | 0.04  | 0.16 | Trace   | —     |
| $19\frac{1}{2}$ lbs „ | 87.89 | 9.06 | 1.07  | 0.62 | (Mn.    | 0.20  |
| 220 lbs „             | 90.43 | 7.62 | 0.72  | 0.15 | 0.03    | 0.03  |
| $5\frac{1}{2}$ lbs „  | 90.13 | 7.24 | Trace | 0.38 | —       | Trace |

#### Schreibersite Graphit etc.

|      |      |
|------|------|
| 2.99 | 1.11 |
| 0.34 | 0.22 |
| 0.56 | 0.34 |
| —    | 0.22 |

(Ann. Ch. u. Phar. 91. 243 and 98. 383.)

#### SIERRA BLANCA. Mexico.

The „Gazeta de Mexico“ 1784—5 vol. 1 p. 200 states that masses of native iron weighing 2000, 3000 and even more, had been found among the mountains. The specimen in the Berlin museum exhibits Widmannstettian figures. (D. M. S. 145.)



**BAHIO. Brazil.**

Discovered in 1784. Described by A.F. Mornay in 1816. The mass was 7 feet long, 4 feet wide and 2 feet thick. Weight 17300. It possessed magnetic polarity. The mass is compact and contains small quantities of magnetic pyrites. The etched surfaces show indistinct Widmannstettian figures. Sp. gr. 7.48.

Analysis by Wollaston Fe 96. Ni 4.

(D. M. S. 121.) (Phil. Trans. 1816 p. 2.)

**ZACATECAS. Mexico.**

Described in the „Gazeta de Mexico Apr. 3. 1792.“ Weight about 2000 lbs. This meteorite contains much pyrites. It is in globular masses and so connected as to form on polished surfaces an imperfect network. It shows no Widmannstettian figures. Sp. gr. 7.55.

Analysis by Bergemann.

| Fe    | Ni   | Co   | Cu   | Mg   | C    | Graphit | Schreibersite |
|-------|------|------|------|------|------|---------|---------------|
| 85.09 | 9.90 | 0.67 | 0.03 | 0.19 | 0.16 | 0.33    | 1.65          |

FeO Cr<sup>2</sup>O<sup>3</sup> S

1.48

4.85

(Pogg. Ann. B. 78. p. 406.)

**CAPE OF GOOD HOPE. Africa.**

Discovered in 1793. It weighed over 300 lbs Capt. Alexander discovered in 1837 many metallic masses of meteoric origin in this locality. The metal is compact and contains some magnetic pyrites. It exhibits no Widmannstettian figures. Sp. gr. 6.63—7.34.

Analysis by Wehrle. Fe 85.608 Ni 12.275 Co 0.887.

More recently analysed by Uricoechea and by Böcking



|            | Fe    | Ni    | Co   | P    | Cu.Sn.S. | Schreibersit |
|------------|-------|-------|------|------|----------|--------------|
| Uricoechea | 81.20 | 15.09 | 2.56 | 0.09 | Trace    | 0.94         |
| Bocking    | 81.30 | 15.23 | 2.01 | 0.08 | ,,       | 0.88         |

(Tillock's Mag. vol. 25. p. 182.) (Gilb. Ann. B. 56. §. 131.)

(Ann. Ch. u. Pharm. 96. 246.)

#### BITBURG. Prussia.

Found in 1805. Weight 3300 to 3400 lbs. It was discovered in repairing an old road. It was nearly all hammered up in an iron furnace. It contains some olivenoid mineral and shows the Widmannstettian figures. Sp. gr. 6.14.

#### Analyses.

|           | Fe    | Ni   | Co   | Mn  | Si   | SiO <sup>3</sup> | S    |
|-----------|-------|------|------|-----|------|------------------|------|
| Stromeyer | 81.8  | 11.9 | 1.0  | 0.2 | —    | —                | 5.1  |
| John      | 78.82 | 8.10 | 3.00 | —   | 0.05 | 5.50             | 4.50 |

(Bruce's Am. Min. Jour. B. 1. 1814.)

(Schw. J. für Ch. u. P. B. 43. S. 22.)

#### TEXAS. Near head of Trinity River.

Described by Col. Libbo in 1814. Found in 1808. This is one of a large number that exist in that locality. Weight 1635 lbs. It is highly crystalline, with octahedral cleavage. It shows beautiful Widmannstettian figures, formed by three sets of long narrow bands. Sp. gr. 7.82.

Analysis. Silliman and Hunt. Fe 9.311. N. 846<sup>2</sup> insoluable Phosphurets 0.500. (Am. J. sc. 3. 44.)

#### BRAHIN. Russia.

Discovered in 1810. Two masses were found weighing together 200 lbs. This meteorite contains many cavities filled with chrysolite, which constitutes nearly one half the mass. The metal when etched shows



bright raised borders around the celles. Sp. gr. 6.20.

Analysis by Laugier. Fe 87.35. Ni 250. Cr 0.50. Mg 2.10. SiO<sub>2</sub> 6.30. S 1.85.

(D. M. S. 90.) (Mém. du Mus. An. 6.)

**ELBOGEN.** Bohemia.

Described in 1811, weight originally 191 lbs. Its form resembled a horses head. The metal is cleavable and malleable, it contains thin veins of pyrites. It gives very perfect Widmannstettian figures in the form of triangles. Sp. gr. 7.74.

Analysis by Berzelius.  
Fe 88.231. Ni 8.517. Co 0.762. Mg 0.279 Phosphurets 2.211.

(Pogg. Ann. 33. 1.) (Gilb. Ann. 42. 147 and 44. 103.)

**DURANGO.** Mexico.

Described by Humboldt in 1811, weight 30,000 to 40,000 lbs. This is a compact metallic mass, exceeding cleavable, and contains a small quantity of magnetic pyrites. It shows fine Widmannstettian figure on etched or tarnished surfaces. Sp. gr. 7.88.

(D. M. S. 112.)

**RASGATA.** NEW-GRENADA. S. Africa.

Discovered in 1810. Described in 1823. Weight of larger mass 84 lbs, of smaller 45 lbs. A vesicular mass containing cavities of various sizes. It is intersected by zigzag seams, and when etched, lines appear which have a resemblance to Widmannstettian figures. The metal is hard but quite malleable. Sp. gr. 7.73—7.77.

Analysis by Wöhler. Fe 92.35. Ni 6.71. Co 0.25. P 0.35. Schreibersite 0.08. Chrysolite? 0.11 Cu? Su? S?

(Ann. de Ch. et Ph. 25. 438.)



**LINARTO. HUNGARY.**

Discovered in Oct. 1814. Weight 194 lbs. It possessed an irregular, tabular form and was crystallized upon its surface in rhomboidal tables. It had a crust of dark brown oxyds. It exhibits Widmannstettian figures in the form of isosceles triangles. Sp. gr. 7.73.

**Analyses.**

|        | Fe     | Ni    | Co    | Mu    | Cu    | Su    | S     | Phosphurets |
|--------|--------|-------|-------|-------|-------|-------|-------|-------------|
| Clark  | 90.153 | 6.553 | 0.502 | 0.145 | 0.080 | 0.082 | 0.482 | 1.226.      |
| Wehrle | 90.88  | 8.45. | 0.66  |       |       |       |       |             |

(Clark on Metallic Meteorits.) (Gilb. 49. 181.)

**FRANCONIA. New Hampshire (U. S. A.)**

A metallic meteorite weighing 16 lbs was found 1816.

Phil. Mag. 4. S. B. 8. p. 461.)

**CAMBRIA. Near Lockport. New York.**

Found in 1818. Described in 1845. Weight 36 lbs. The mass was of an irregular, elongated form, 18 inches long, and  $5\frac{1}{2}$  in diameter. It affords fine Widmannstettian figures. It is vesicular, and the cavities are filled with pyrites. It has a thick crust of oxyds. Sp. gr. 7.5257.

Analysis by Silliman and Hunt. Fe 32.583. Ni 5.708. Cu? insoluble 1.400. The latter contains Fe 44.1. Ni 24.5. P 11.4. Si? 10.0.

(Am. J. sc. 44. 338 und 25. 2. 377.)

**BURLINGTON. Otsego Co. New York.**

Described by Silliman J in 1844. It was ploughed up sometime previous to 1819, and weighed 150 lbs. It was of a conical form and was covered with its original crust. It is highly crystalline. The polished



surface has a bright lustre, with the color of german silver. It shows Widmanstettian figures. Sg. gr. 7.728.

Analyses.

|          | Fe     | Ni    | Co    | Cu | Mu | Insoluble<br>Phosphurets | S      |
|----------|--------|-------|-------|----|----|--------------------------|--------|
| Clark    | 83.752 | 8.897 | 0.625 | ?  | ?  | 0.703                    | —      |
| Rockwald | 92.291 | 8.146 | —     | —  | —  | —                        | —      |
| Shepard  | 95.200 | 2.125 | —     | —  | —  | 0.400                    | 2.175. |

(Clark on metallic meteorites p. 61.) (Am. J. sc. 46. 401.)

(Rep. Am. M. 22.)

#### GREENLAND. North coast of Baffins Bay.

Described by Capt. Ross in 1819. It is very malleable, silver white and not easily oxydized. It contains nickel, pyrites and an unknown mineral. Sp. gr. 7.23. It contains 3 pre Cent. Ni. (D. M. 135.)

#### GUILFORD COUNTY. North Carolina. U. S. A.

Found in 1820, described by Shepard in 1841, weight 28 lbs. A compact metallic mass, showing very perfect Widmanstettian figures. Sp. gr. 7.67.

(Ann. J. sc. 40. 369.) (Rep. Am. M. 24.)

#### RONDOLPH COUNTY. North Carolina. U. S. A.

Described by Olmsted in 1822. Weight 2 lbs. It was long supposed to be terrestrial native iron. It is foliated in structure and resembles in color and lustre mispickel. When etched it shows very fine lines, very hard, said to contain cobalt and silicon? in minute quantity. Sp. gr. 7.618.

(Am. J. sc. 5. 262)

#### CAILLE. Dep. du Var. France.

Discovered to be of meteoric origin and described in 1828; although it had served as a bench before the



church in Caille for 200 years. The mass is crystalline and cleaveable. Sp. gr. 7.64.

Analysis by De Luynes Fe 82.63. Ni 17.37. Cu? Mu?

More recently analysed by Rivot Fe 92.3. Ni 6.2. Si 0.9. CO. Cr. Trace.

(Ann. des Mines t. 5. Ser. 4.) (Ann. des Mines t. 6. Ser. 5.)

#### BEDFORD COUNTY. Penn. U. S. A.

Described as native iron in 1828. Weight a few ounces. From its resemblance to the Ranolph county specimen Shepard supposes it to be meteoric.

(Rep. Am. M. 32.) (Am. J. sc. 14. 183.)

#### BOHUMILITS. Bohemia, Germany.

Found Sep. 19. 1829. Described in 1830. It was covered with a crust of limonite. It is composed of a metallic mass, a large quantity of magnetic pyrites and an unknown substance which is black not very hard and not Graphite. When etched it exhibits figures in the form of wide bands which are generally parallel. Sp. gr. 7.61.

#### Analyses.

|           | Fe     | Ni    | Co    | S    | insoluble |
|-----------|--------|-------|-------|------|-----------|
| Steinmann | 94.06  | 4.01  | —     | 0.81 | 1.12      |
| Berzelius | 94.775 | 3.812 | 0.213 | —    | 2.200     |

The crystalline magnetic scales insoluble in nitric acid gave Berzelius Fe 65.987 Ni 15.008 Si 2.057 C 1.422 P 14.023.

(Pogg. Ann. 27. 118.)

#### WALKER. COUNTY. Alabama. U. S. A.

Found in 1832. Described by Trost in 1845. Weight 165 lbs. It was covered with a smooth black crust. It gives no Widmannstettian figures but only a few



angular dots and lines. But the fracture is very crystalline. Sp. gr. 7.265.

Analysis Shepard. Fe 99.98 Ca ? Mg ? Al ?

(Am. J. sc. vol. 49. 344.)

SCRIBA. Oswego. Co. New York. U. S. A.

Described by Shepard in 1841. Weight 8 lbs. It was found in the forest. It much resembles the Walker County mass and Shepard supposes it to be of meteoric origin, though it exhibits no figures and contains no nickel.

Analysis by Shepard. Fe 99.66 Si.0.20 Ca0.09.

(Am. J. sc. 40. 366.)

CLAIBORNE. Clarke Co. Alabama. U. S. A.

Described by Jackson in 1833. Weight 40 lbs. This is a compact metallic mass mixed with insoluble pyrites. It gives no Widmannstettian figures. Sp. gr. 6.5.

#### Analyses

|         | Fe     | Ni     | Mn    | S     | Cl    | Pyrites |
|---------|--------|--------|-------|-------|-------|---------|
| Jackson | 66.560 | 24.708 | 3.240 | 4 000 | 1.480 | —       |
| Hayes   | 83.572 | 12.665 | —     | —     | 0.907 | 2.395.  |

(Am. J. sc. 34. 332.)

CHARLOTTE. Tickson. Co. Tenn. U. S. A.

This metallic meteorite was seen to fall July 31 or Aug. 1. 1835. Weight 9 lbs. Its loud explosion was heard by several persons. It has a closely crystalline structure. The external surface resembles smooth cast-iron; but with a high magnifying power it shows a net work of equilateral triangles, formed by the crossing of thin plates.

(Pogg. Ann. R. 3. B. 12.) (Am. J. sc. 49. 337.)



**BLACK MOUNTAIN.** Buncombe. Co. N. Carolina.

Found in 1835. Described by Shepard in 1848. The only specimen known weighs 21.3, but this was evidently detached from a larger mass. It is highly crystalline but exhibits no Widmannstettian figures. It shows veins of magnetic pyrites. Sp. gr. 7.261.

Analysis by Shepard. Te 96.04 Ni 2.52 Insoluble 1.44. (Rep. Ann. M. p. 28.)

**ASHEVILLE.** Buncombe. Co. N. Carolina.

Found in 1839. Described by Shepard in 1839. A spherical mass (30 lbs) the size of a man's head. It is compact and highly crystalline in structure, containing a small quantity of magnetic pyrites. Sp. gr. 7.80.

Analysis by Shepard. Fe 94.5 Ni 5 Co ? Si 0.3 Mg ? P ? (Am. J. sc. 36. 81.)

**PUTNAM COUNTY.** Georgia.

Found in 1839. Described by Willet in 1854. Weight 72 lbs. It is very tough oxydizes very easily and shows a crystalline structure. Nitric acid brings out beautiful Weidmannstettian figures; which are an exact copy of the Texas iron. Sp. gr. 7.69.

Analysis by Shepard. Fe 89.52 Ni 8.82 Sn P S Mg Ca 1.66. (Am. J. sc. 2. S. vol. 17. p. 331.)

**COCKE.** County, near Crosby's Creek Tennessee.

(U. S. A.)

Described by Trost in 1840. Of this meteorite there are two masses, one weighing 2000 lbs the other 112 lbs. The metal was so white and malleable that the finder supposed it to be a mass of silver. The specimens from this meteorite are mostly octahedral crystals



detached from the surface of the original mass. It contains a small quantity of magnetic pyrites and a large amount of a mineral supposed to be graphite. Sp. gr. 4.454.

Analyzed by Joy. Fe 91.63 Ni 5.85 Co 0.81  
P 0.19 Cu + Sn 0.22 Mn 0.09 Graphite 0.80  
SiO<sub>3</sub> 0.08 S ?

(Am. J. sc. 38 250 and 43. 354.)

#### DESSERT TARAPACA. in Chili, S. America.

Found by Mr. Greenwood, in 1840. Described by R. P. Gregg in 1854. It is a lengthened mass weighing 17 lbs. The surface contains many depressions. It is uncommonly soft and shows no Widmannstettian figures. Sp. gr. 6.5.

Analyzed by Darlington.

| Te    | Ni   | Co   | Mn   | Cr     | Schreibersite. |
|-------|------|------|------|--------|----------------|
| 93.41 | 4.62 | 0.36 | 0.20 | Trace. | 1.21.          |

(Phil. Mag. 4. S. vol. 10 p. 12.)

#### PETROPAWLOWSK. Siberia.

Described by Sokolowskji in 1841. Several small specimens of meteoric metal were found 31 feet below the surface of the soil. The largest weighed 17½ lbs and was coated with a thick crust of hydrated oxyds. Sp. gr. 7.76.

Analyzed by Sakolowskji. Fe 97.29. Ni 2.07.

(Pogg. Ann. 50.676.) (Ermans Archiv für wissensch. Kunde  
von Russland 1841.)

#### NEWBERRY. S. Carolina. (U. S. A.)

Discovered in 1841. Described by Shepard in 1850. An irregular ovoidal mass 31½ inchs long and 29¾



in breadth, weight 117 lbs. The metal is malleable, homogeneous and highly crystalline, and exhibits the Widmannstettian figures. It contains masses of a brilliant pinchbeck-red pyrites. Sp. gr. 7.10.

Analysis by Shepard. Fe 96.00 Ni 3.121, with traces of R. S. Co and Mg.

(Am. J. sc. 2. S. vol. 10. p. 128)

**BABBS MILL.** Green, Co. Tenn. V. S. A.

Found in 1842. Described by Trost in 1845. Then were two fragments found, one 12 lbs the other 6 lbs. They are tough and malleable and have a fine crystalline structure, and are susceptible of a high polish. They show no Widmannstettian figures. Sp. gr. 7.839.

**Analyses.**

|         | Fe     | Ni     | Co    | Mn | Insoluble | Si | Mg | Ca |
|---------|--------|--------|-------|----|-----------|----|----|----|
| Clark   | 80.594 | 17.104 | 2.037 | ?  | 0.124     | ?  | ?  | —  |
| Shepard | 85. 30 | 14. 70 | —     | —  | —         | —  | ?  | ?  |
| Troost  | 87. 58 | 12. 42 | —     | —  | —         | —  | —  | —  |

(Clark on metallic meteorites p. 65) (Am. J. sc. 43. 342. p. 119)

**ST. AUGUSTINE BAY.** Madagascar.

Large quantities of meteoric iron were found in 1843.

**SZLANICZA.** Near Arva in Hungary.

Found in 1843. Described by Haidinger in 1844. It was found in digging for iron ore. It consist of a multitude of small, elipsoidal globules of metal cemented together by thin veins of pyrites and crystalline plates of Schreibersite. It displays no Widmannstettian figures. Sp. gr. 7.1.

Analyses: Patera found Fe 89.42 Ni and Co 8.91



S. C. Si. Cu and Schreibersite 1.41. And the Schreibersite he found to contain Fe 87.20 Ni 4.24 P 7.26. C? Loewe found Fe 90.47 Ni 7.32 Co, Si, S, C and Schreibersite 1.40. Bergmann found Fe 74.18 Ni 4.15 Co 0.21 S 15.36 P 0.20 soluble 5.91.

(Berichte. Mitt. F. N. in Wien. B. 3.)

(Jahresberichte, Liebig u. Kopp 1847—8.)

(Pogg. Ann. 100. 257.)

#### CARTHAGE. Smith Co, Tennessee.

Found probably in 1844. Described by Troost in 1846. Weight 280 lbs. It was an oblong mass, of very tough and malleable metal. Octahedral crystals project from the surface, and this interior is so highly crystalline that it exhibits magnificent figures on merely polished surfaces. It contains nickel.

(Am. J. sc. 2. S. vol. 2. p. 357.)

#### MORCORITA. S. America.

1844 Jan. A large metallic meteorite fell in Caritas Paso on the river Morcorita. The fall of this interesting meteorite was witnessed by an army of 1400 men. It was doubtless deeply inbedded in the soil and yet a cubic yard remained above the surface. It was so intensely heated that an approach nearer than ten paces was impossible. Farther information from this is not known.

(Phil. Mag. 4. S. vol. 10. p. 14.)

#### OTSEGO COUNTY. New York, (U. S. A.)

Found in 1845. Described by Shepard in 1848. The smallest of known metallic meteorites. Weight 18.5 grammes. It has an ovoid form, and is covered with



a black crust. It has a finely crystalline structure and contains small particles of magnetic pyrites.

Analysis by Shepard: Fe 94.57 Cu. Ni. Co. S and C 5.43.

(Rep. Am. M. 32.) (Jahresberichte Liebig u. Kopp 1847—8.)

**HOMMONEY CREEK.** Buncombe Co. N. Carolina.

Found in 1845. Described by Shepard in 1848. Weight 27 lbs. The structure is exceedingly vesicular, the cavities being from  $\frac{1}{4}$  to  $\frac{1}{20}$  of an inch in diameter, and lined with a black powder. The metal is somewhat malleable and when etched exhibits in places small triangular figures. Sp. gr. 7.32.

Analyses.

|         | Fe    | Ni + Co | Cu + Sn | Mn | Si   | P | S    | Graphit and<br>Schreibersite |
|---------|-------|---------|---------|----|------|---|------|------------------------------|
| Clark   | 93.23 | 0.25    | 0.10    | ?  | 0.50 | ? | 0.54 | 4.77                         |
| Shepard | 98.19 | 0.23    | —       | —  | —    | — | —    | 1.58                         |

(Rep. Am. M. 25) (Clark on metallic meteorite p. 22.)

**DE KALB COUNTY.** Tennessee. (V. S. A.)

Described by Troost in 1845. Weight 36 lbs. Of a coarsly crystalline structure, exhibiting very regular Widmannstettian figure, masses of a black mineral supposed to be graphite are dispersed through the metal.

(Am. J. sc. 49. 341.)

**JACKSON, County.** Tennessee.

Described by Troost in 1846. Only 15 Oz. The specimen is an accumulation of large octahedral and tetrahedral crystals of a soft malleable metal.

(Am. J. sc. 2. S. vol. 2.)

**COUNTY DOWN.** Ireland.

Fell August 10. 1846. Described by Shepard 1851



The metal is malleable, homogeneous and somewhat vesicular. It exhibits no Widmannstettian figures, and contains no nickel, cobalt or sulphur. The vagueness of the account given and the want of all usual distinguishing characteristics renders it a doubtful meteorite.

(Am. J. sc. 2 S. vol. 2. p. 37.)

**SMITHLAND.** Tennessee, (U. S. A.)

Described by Troost in 1846. It was found many years previous and most of it was forged up by a blacksmith. Eight or ten pounds were found in its original condition, having a fine granular texture. It exhibits no Widmannstettian figures when etched, though containing about 10 per cent of Nickel.

(Am. J. sc. 1. S. vol. 2. p. 357.)

**HAUPTMANSDORF.** Near Brannau, Bohemia.

This remarkable meteorite fell July 14. 1847. Its fall was attended with the usual phenomena of these meteoric falls. Two masses were found, one 42 lbs the other 30 lbs. The color was iron gray. The inner mass is in the highest degree crystalline, so that it may be cleaved in three directions parallel to the faces of a cube almost as easily as Galena. Sp. gr. 7.714.

Analysis Duflos and Fischer. Fe 91.88. Ni 5.52. Co 0.53. Mn. Cu. Ca. Mg. Si. Cr. S. P. C. Cl. 2.07.

(Bericht M. T. N. in Wien B. 3. 302. 378.)

(Pogg. Ann. B. 72. 475. 575. 580.)

**CHESTERVILLE.** Chester, Co. S. Carolina, (U. S. A)

Described by Shepard in 1849. Found in 1847. Weight 96 lbs. It was mostly forged up before its meteoric character was known. The metal is com-



compact and malleable, and contains small quantities of pyrites and graphite. It exhibits Widmannstettian figures and other characters resembling Chinese letters. Sp. gr. 7.818.

Analysis Shepard. Fe 95. Ni 5. Co ? Cr ?

(Am. J. sc. 2. S. vol. 7. p. 493.)

#### SEELÄSGEN. Silesia, Austria.

Described by Göppert in 1847. Weight 218 lbs. It was found in ditching a meadow, and was 14 feet below the surface. It consists of a malleable, homogeneous metal, containing an unusually large quantity of pyrites, etched surfaces appear rough and granular but exhibit no Widmannstettian figures. Sp. gr. 7.70.

|             | Fe    | Ni   | Co   | Cu   | S    | Graphite | Cr | Mn   |
|-------------|-------|------|------|------|------|----------|----|------|
| Rammelsberg | 92.33 | 6.23 | 0.67 | 0.05 | 0.03 | 0.703    | ?  | —    |
| Duflos      | 90.00 | 5.31 | 0.43 | 0.10 | 1.16 | 0.834    | ?  | 0.91 |

Rammelsberg found the composition of the pyrites to be

| S     | Fe    | Ni   | Co   | Cu   | FeO  | FeOCr <sup>2</sup> O <sup>3</sup> |
|-------|-------|------|------|------|------|-----------------------------------|
| 28.16 | 65.82 | 1.37 | 1.37 | 0.57 | 0.87 | 1.06                              |

(Bericht, M. F. N. in Wien B. 3.) (Pogg. Ann. R. 3. B. 14.)

#### FORT SINPHUR, India.

Described by Giraud in 1849. Weight 31 lbs. It was found on a basaltic mountain, 4500 feet above the sea. It is exceeding vesicular, the cavities being filled with a yellow earthen olivenoid substance. The metal contains several percent Nickel.

(Edinb. New Phil. J. 47. 53.)

#### SCHWETZ, Prussia.

Found in 1850. Described by G. Rose in 1851.



Weight 43 lbs It was found 4 feet below the surface, and had a thin crust of oxyds. The inner mass had three seams through which it was easily cleaved. It exhibits very perfect Widmannstettian figures. Sp. gr. 7.77

Analysed by Rammelsberg.

|                  | Fe    | Ni    | Co   | Insoluble | Cu   | Cr  | P     |
|------------------|-------|-------|------|-----------|------|-----|-------|
| Metallic portion | 93.18 | 5.77  | 1.05 | 0.98      | —    | —   | —     |
| Insoluble „      | 22.59 | 34.77 | —    | —         | 4.74 | 3.9 | 34.13 |

(Pogg. Ann. B. 33 u. B. 84.)

**PITZBURGH.** Pennsylvania. (U. S. A.)

Found 1850. Described in 1851. Sp. gr. 7.38.

(Proc. Am. Assoc. 1851 p. 339.)

**TAZEWELL.** Claiborne. Co. Tennessee. (U. S. A.)

Discovered by Rogers in 1853. Described by J. L. Smith in 1854. Weight 55 lbs. It is flattened in shape and has three angular openings passing through the mass. It was covered with a thin coating of oxyds. It is very hard, has a white color and hot nitric acid brings out fine Widmannstettian figures. It contains chloride of iron in some of the veins and Prof. Smith supposes this to be of meteoric origin, but without doubt it is a formation since its fall. Sp. gr. 7.88 to 7.91.

Analysis by Smith.

| Fe    | Ni    | Co   | Cu   | P    | Cl   | S    | SiO <sup>3</sup> | MgO  |
|-------|-------|------|------|------|------|------|------------------|------|
| 83.02 | 14.62 | 0.50 | 0.06 | 0.19 | 0.02 | 0.08 | 0.84             | 0.24 |

(Proc. Am. Assoc. 1854.) (Am. J. sc. 2. vol. 19. p. 153.)

**UNION COUNTY.** Georgia. (U. S. A.)

Found in 1853. Described by Shepard in 1854. Original weight 54 lbs. It had a brownish covering of oxyd of iron. It contains large almond-shaped



masses of pyrites. The polished surface has a silver white color, but it gives no Widmannstettian figures. Sp. gr. 7.07. It contains 3.32 procent nickel.

(Am. J. sc. 2. S. vol. 17. p. 328.)

**LONG CREEK. Jefferson. Co. Tennessee.**

Found 1853. Weight  $2\frac{1}{2}$  lbs. It is difficult to break and scarcely malleable. The surface is granular and of an iron gray color and shows no Widmannstettian figures. Sp. gr. 7.93.

Analysis by Shepard. Fe 95.57 C 3.30 Cr Sn Mo 1.13 Si Ti P S Trace. Can it be meteoric?

(Am. J. sc. 2. S. vol. 17. p. 329.)

**CAMPBELL COUNTY. Tennessee. (U. S. A.)**

Found in July. 1853. It is a small oval mass  $2\frac{1}{2}$  inches long,  $1\frac{3}{4}$  broad and  $\frac{3}{4}$  thick. Weight  $4\frac{1}{3}$  Oz. The metal is quite tough, highly crystalline and contains small cavities. When etched it exhibits Widmannstettian figures. Sp. gr. 7.05.

Analysis by Smith.

| Fe    | Ni   | Co  | C    | P    | SiO <sup>3</sup> |
|-------|------|-----|------|------|------------------|
| 97.54 | 0.25 | 0.6 | 1.50 | 0.12 | 1.05             |

(Am. J. sc. 2. S. B. 19. p. 159.)

**TARBARY. Thuringia. Germany.**

Found Oct. 18. 1854. A shepherd, who saw it fall, picked it up and found it still warm. This is doubtful as it is much oxydized on the surface. The mass weighed but a few ounces. It has an uneven surface and shows plainly the Widmannstettian figures. Sp. gr. 7.737.

Analysis by Eberhart.



| Fe    | Ni   | Co   | P    | Schreibersite |
|-------|------|------|------|---------------|
| 92.76 | 5.69 | 0.79 | 0.86 | 0.28.         |

(Ann. Ch. u. Pharm. 96. 286.)

#### MADOC. Canada.

This mass of metallic iron was discovered in 1854. Weight 370 lbs. The surface has many depressions. The metal is soft and malleable and has a closely crystalline structure. It contains 6.35 per cent nickel.

(Am. J. sc. 2. S. vol. 19. p. 117.)

#### HAYWOOD COUNTY. N. Carolina.

This specimen weighs only  $\frac{1}{8}$  of an ounce. The locality could not be given further than that it was found in the above county. It is probably a piece from some already known meteorite. It is highly crystalline and the etched surface is identical with the Haupmansdorf iron. Sp. gr. 7.42. It contains nickel, phosphorus, and chromium.

(Am. J. sc. 2. S. vol. 17. p. 327.)

#### NEW MEXICO.

The locality is not given. It was held for a specimen of „Native iron“ and is said to occur in its original locality in great quantities. It is crystalline, has an iron-gray color and is quite malleable. Sp. gr. 8.13.

Analyzed by Genth. Fe 95.92 Ni + Co 3.57 Insoluble 0.57. The Insoluble part contained Fe 55.07 Ni 28.78 Titanium? 16.15.

(Am. J. sc. 2. S. vol. 17. p. 239.)

#### POTOSI. S. America.

Described in 1839. It is highly vesicular, some of the cavities being empty and others filled with a greyish



olivenoid mineral. The metal is malleable and very tough. Sp. gr. 7.736.

Analysis by Morren. Fe 90.241 Ni 9.759.

(Pogg. Ann. B. 47. 470.) (Phil. Mag. 3. S. Bd. 14. p. 394.)

**CAYUGA. COUNTY.** Near Seneca river. New York.

First described by Prof. O. Root. Weight 8 or 10 lbs. It had a thick crust of hydrous oxyd of iron. It is crystalline and shows the Widmannstettian figures. It takes a high polish and has a grayish white color. Sp. gr. 7.337.

Analysis by Shepard. Nickeliferous iron 98.69 Partschite !! 1.05 Dyslytite !! 0.25 Chromite 0.01. The Nickeliferous iron gave. Fe 92.40 Ni 7.60.

(Am. J. sc. 2. S. vol. 15. p. 363.)

**LION RIVER.** S. Africa.

This specimen was brought from Cape of good Hope to London in 1852. Was soon obtained by Shepard. Weight 178 lbs. It is an oblong ovoidal mass resembling a horse's head. The metal is soft, homogeneous closely crystalline and compact. The etched surface shows Widmannstettian figures. Sp. gr. 7.45.

Analysis by Shepard. Ni 6.70 Fe. P. S. Sn 93.30.

(Am. J. sc. 2. S. vol. 15. p. 1.)

**OAPACA.** Mexico.

Described by Partsch in 1843. The metal is compact and exhibits on etched surfaces crooked bands, the crystalline structure having been distorted by hammering. Sp. gr. 7.38. (D. M. p. 134.)



**SALT-RIVER. KENTUCKY. (U. S. A.)**

Sp. gr. 6.835. (Am. J. sc. 2. S. vol. 11. p. 40.)

**MURFREESBORO. Tennessee. (U. S. A.)**

Described by Troost in 1849. Weight 18 lbs. It is of an iron-gray color, very malleable and of crystalline fracture. The etched surfaces show Widmannstettian figures.

Analysis by Troost. Fe 96.00 Ni 2.40 Insoluble 1.60. (Am. J. sc. 2. S. vol. 5. p. 361.)

**GRAYSON COUNTY. Tennessee. (U. S. A.)**

Described by Rogers in 1842. Contains 6.15 per cent of Nickel. (Am. J. sc. vol. 43. p. 169.)

**ROANOKE COUNTY. Virginia. (U. S. A.)**

Described by Rogers in 1842. (Am. J. sc. vol. 43. p. 169.)

**ALASEJ. Mountains. Siberia.**

Large quantities of excellent iron are said to be found among these mountains and to be employed by the natives in manufacturing knives etc. (D. M. p. 144.)

**TUCZON. Sonora. New Mexico.**

Dr. J. L. Le Conte, in 1851, first described two meteoric masses at the above locality which were used as anvils by the blacksmiths. In 1853 J. G. Parke obtained a few small fragments. There is another large mass in the same valley where the two anvils were obtained. The etched surface shows no Widmannstettian figures but has an amygdoloidal appearance. Sp. gr. 6.66. A qualitative analysis showed it to contain much nickel. (Am. J. sc. 2. S. vol. 18. p. 369.)



**ORANGE RIVER COUNTRY. S. Africa.**

This valuable meteorite was brought from Africa to London in 1855, and soon after taken to America by Prof. Shepard. Weight 328 lbs. It is irregular in shape and the surface contains many depressions. It has a thin black crust closely adhering to the mass. It is soft, homogeneous and very crystalline. It cleaves with facility. The polished surface has no tendency to oxydation and reveals the most perfect figures. Sp. gr. 7.3.

Analysis by Shepard. Fe 90.48 Ni 8.94. Chladnite 0.56 Schreibersite 6.02.

(Am. J. sc. 2. S. vol. 21. p. 213.)

**NIAKORNAC. Greenland.**

Described by Forchhammer in 1854. Weight 21 lbs. Hardness equal to that of steel. It was not malleable. With nitric acid it affords fine Widmannstettian figures. Sp. gr. 7.02.

Analyzed by Forchhammer.

| Fe    | Ni   | Co   | Cu   | S    | P    | C    | Si    |
|-------|------|------|------|------|------|------|-------|
| 93.39 | 1.56 | 0.25 | 0.45 | 0.67 | 0.18 | 1.69 | 0.38. |

(Pogg. Ann. 93. 155.)

**COAHUILA. Mexico.**

Weight 252 lbs. It is very crystalline in structure, malleable, and when etched exhibits distinctly Widmannstettian figures.

Analysis. Fe 95.82 Ni 3.18 Co 0.35. P 0.24 Cu Trace.

(Jahrb. der Miner. 1855.)

**TOLUCA. VALLEY. Mexico.**

This general locality is already mentioned under the



name Ziquipilco (page —). Since the first notice of this locality in 1784 many explorations of this valley have been made at different times and many separate localities of this meteoric iron found. Dr. Burkart has brought to Europe several specimens and has given a full description of the localities (Jahrb. der Miner. 1856.) In the neighborhood of Sierra Blanca he mentions four localities between Durango and Chihuahua; the first near *Huajuquillo*, the second in the district *Conception*, the third; the south west part of the district *Bolson de Mapimi*, the fourth in the district *Venagas*.

Dr. Krantz in Bonn has obtained from different localities in this valley 60 specimens of meteoric iron in all weighing about 120 lbs. (Pogg. Ann. 101. 152.) It has been a question whether all this quantity of meteoric iron found in this region, is the result of one meteoric shower or of several. It seems more probable that it is from one.

Dr Bergemann has analyzed two specimens, the one from *Misteca* in the state of Oojaca, the other from Ocatitlan.

|           | Fe    | Ni   | Co   | P     | S    | Insoluble. |
|-----------|-------|------|------|-------|------|------------|
| Misteca   | 88.86 | 9.92 | 0.75 | 0.07  | 0.55 | 0.97       |
| Ocatitlan | 85.49 | 8.17 | 0.56 | trace | —    | 5.00       |

In the latter analysis sulphur was determined but he has reckoned the amount of sulphuret of iron out of the whole result.

(Pogg. Ann. 100. 245.)

LOCALITY. Unknown.

Several years since Prof. Wöhler found a small specimen of a metallic meteorite unlabeled among the



minerals of this illustrations predecessor Stromeyer. Weight 2 Oz. The etched surface shows no Widmannstettian figures but one or two sets of parallel lines which give a peculiar glitter from reflected light.

Analyzed by Manross.

Fe Ni + Co Sn Schreibersite.

|       |      |      |      |
|-------|------|------|------|
| 92.33 | 7.38 | 0.03 | 0.42 |
|-------|------|------|------|

(Clark on metallic meteorites p. 76.)

collected in this valley by specimens of material from the



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# ERRATA.

|      |     |                                          |
|------|-----|------------------------------------------|
| Page | 11  | „comes“ to be omitted.                   |
| „    | 27  | for „unsubstantiable“ read — Untenable.  |
| „    | 29  | „ „desolved“ read — dissolved.           |
| „    | „   | „ „determination“ read — determinations. |
| „    | „   | „ „Potasso“ read — Potassa.              |
| „    | 31  | „ „Undercomposed“ read — Undecomposed.   |
| „    | 36  | „ „respect“ read — resprcts.             |
| „    | 37  | „ „To weigh“ read — to be weighed.       |
| „    | 38  | „ „form“ read — for.                     |
| „    | 46  | „ „messrs“ read — Messrs.                |
| „    | 51  | „ „he“ read — they.                      |
| „    | 76  | „ „A <i>Nondescript</i> read — both are. |
| „    | 78  | „ „colon“ read — color.                  |
| „    | 85  | „ „as simond“ read — at Simond.          |
| „    | 86  | „ „there“ read — three.                  |
| „    | „   | „ „stonels“ read — stones.               |
| „    | 89  | „ „government“ read — district.          |
| „    | 91  | „ „fine“ read — finely.                  |
| „    | „   | „ „reperted“ read — reported.            |
| „    | 92  | „ „near“ read — in.                      |
| „    | „   | „ „Schepard“ read — Shepard.             |
| „    | 98  | „ „as peas“ read — as a pea.             |
| „    | 105 | „ „Wehle“ read — Wehler.                 |

Note The size of this dissertation has far exceeded its proposed limits; yet the author, in its compilation, has studied condensation, even perhaps at the expense of perspicuity. — The typographical errors must find an apology in the fact that it was printed in a German Press where English was not understood.



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